NAVAL FIGHTERS NUMBER FORTY

Grumman F11F TIGER

BY CORWIN "CORKY" MEYER

SQUADRON HISTORIES BY STEVE GINTER

EDITORS NOTE

The critics often dismiss the Tiger as a short-legged underpowered also-ran. I, however, rank it as the Navy's '57 Chevy of the '50s, and its '63 Corvette of the '60s. One look at the sleek, clean, classic lines of the Tiger makes me want to climb in and strap it on. This is the same feeling I get when looking at the F8F Bearcat. Both the Tiger and the Bearcat are the smallest airframes built around their respective engines and as such speak to me of quick-responsive-speed and agility. I have never felt that way about the mainstay of Americas freedom, the F-4 Phantom. Even the fabulous F-8 Crusader, the "Last Gunfighter", can't compete. You can certainly strap that "puppy" on and easily leave the Tiger in the dust, but you can't make it maneuver like a Tiger. What other airplane could do the F11F trademark Blue Angel maneuver of the six plane formation take off and landing. Now that was the essence of "NAVAIR FOREVER".

On the practical side, the deployed F11F squadrons had the lowest accident rates and usually recorded the most flight hours of any shipboard unit. This was due to the honest flight characteristics, airframe strength, and low maintenance requirements of the Tiger. For true greatness the F11F should have have had a different engine. Grumman would remedy this with the Phantoms J79 in their F11F-1F Supertiger. That story will be told in Naval Fighters Number Forty-Four, Grummans International Tiger, the F11F-1F Supertiger by Corwin "Corky" Meyer.

"Air Force Wings Are Made Of Lead"!
Steve Ginter 1997.

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ABOUT THE AUTHOR

Corwin "Corky" Meyer grew up in Springfield, Illinois. He attended the University of Illinois and the Massachusetts Institute of Technology. His test flying career spans 55 years in more than 125 different types of civilian and military aircraft.

Mr. Meyer joined the Grumman Aircraft Engineering Corporation in 1942 as an experimental test pilot. He became project pilot for the following fighters: Hellcat, Tigercat, Bearcat, Panther, Jaguar, Tiger, and the Mach two Super Tiger. He flew many tactical aircraft made throughout the world, including the Japanese Zero and the A-6 Intruder. In 1954, he became the first civilian pilot to qualify aboard the USS Lake Champlain (CVA-39) in Cougars with VF-61. In 1965, he became Director of Aircraft Delivery Operations, and in 1969, he became Senior Vice President of all Manufacturing Operations and Quality Control. In 1974, he was elected President and CEO of Grumman American, a commercial airplane subsidiary.

After retiring in 1978, he became President and CEO of Enstrom Helicopter Corporation, Falcon Jet Corporation, and OMAC with special tasks to realign the operations of these corporations. Mr. Meyer is a Fellow of the Society of Experimental Test Pilots and an Associate Fellow of the American Institute of Astronautics and Aeronautics. He also served as a consultant to the European research organization AGAARD (a NATO Committee for Research and Development) and NASA. Mr. Meyer has a daughter, Sandra Louise, and two sons, John Fyfield and Peter Corwin.

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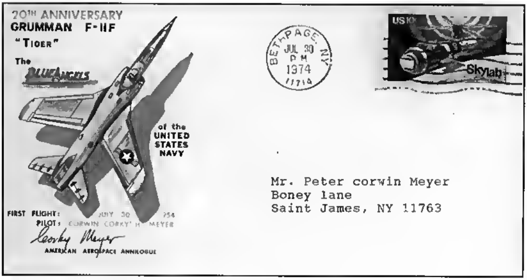
FRONT COVER: Tigers on the prowl. Classic and often used echelon photo of VF-21 "Mach Busters" tells it all. (MFR)

BACK COVER: Top, commissioned painting by William H. Eddy of VF-33 "Astronauts" Tiger on the elevator of the USS Intrepid (CVA-11). For further information on Mr. Eddy's Art Work and available prints, he can be contacted at 139 Surrey Lake, Crystal Lane, IL, 60014, or by calling him at (815) 459-9021. Middle, VF-21 Tiger with ATG-181 "AM" tail code being respotted on big deck of the USS Forrestal (CVA-59) in 1958. (via Gerry Markgraf) Bottom, extremely colorful prototype Tiger BuNo 130606, note partially deployed nose and fuselage speed brakes. Grumman designed area ruled tanks which were never used operationally are seen here with experimental rear fins. (via Craig Kaston)



THE GRUMMAN F11F-1 TIGER BY CORWIN "CORKY" MEYER

FORWARD

The full story of the Grumman Tiger and Super Tiger has only been told in part by non-Grumman aviation buffs and historians who wrote from second or third hand-information.

Although it is over forty years later, this compendium has been written and documented by the principal Grumman and Blue Angel actors who participated in the development of those fine aircraft that came upon the scene at a very difficult but interesting era for both Grumman and the Navy.

The Navy's carrier forces needed a supersonic fighter to stay competitive with the USAF. In addition to US manufacturers, four major and many minor nations of the world were vying to get into the American supersonic fighter arena. Very little US government supervision was exercised over the sellers.

The Tiger was a new aircraft development program financed by the Navy almost illegitimately as a stepchild of the on-going Grumman Cougar program. By the time that the Super Tiger had demonstrated its outstanding supersonic performance, both the USAF and the Navy had committed large sums of money to other supersonic fighter programs. This left little funds or interest available for the Super Tiger.

Internationally however, with only six full-time but untrained sales people the Super Tiger came in first in four of the first-round international competitions against an entrenched, professional American international competitor, Lockheed! The foreign sales program did not have the attention of Grumman's top management for two reasons. First, they did not believe in selling first-line aircraft to former enemies. Second, they had also decided the era of the fighter had ended and the company should turn its efforts to systems-oriented aircraft.

In spite of the Tiger's limited Navy usage, it set two enviable safety records and one maintenance record. It was the first Navy jet aircraft to have an accident-free carrier record for its first year of operations on straight deck carriers. Then, during its first year with jet training units as a single-seat trainer, 84 pilots were graduated without an accident. It also exhibited the fewest maintenance hours of its peers at 4 to 6 man-hours per flight-hour.

Above, the wood mock-up of the Tiger was completed on 23 March 1953. A mock-up board from many sections of the Navy convened from 13 to 16 June at Grumman to make final decisions about the cockpit, locations of the equipment, etc. The front speed brake had not been added yet. Wind tunnel tests showed that the pitching moments of the single speed brake were overpowering and the front brake was added to counter-act them. It proved to be a good balance in flight. (Grumman via C. Meyer)

Finally, the Tiger was flown by the Navy's Blue Angels Flight Demonstration Team for thirteen years (1957-1969), the longest that any single aircraft to date has been in use by the Blues.

THE GRUMMAN F11 TIGER: A RACE FOR NAVAL SUPERSONIC SUPREMACY

INTRODUCTION

There have been many opinions propounded by both Grummanites and by non-Grummanites as to why the F11F-1 came into being. The real

reasons are to be found in the generation of Naval airplanes and the interservice rivalries that came right after World War II, but before the Tiger was a gleam in its designers' eyes.

THE USAF, NAVY & RUSSIAN FIGHTER SITUATION

The USAF had picked up the German swept-wing and jet propulsion philosophies immediately after the war. Before the first series of USAF straight-wing, jet powered fighters were in squadron service the USAF had several swept-wing airplanes under development. The F-86 first flew on 1 October 1947 and the Republic F-84F on 3 June 1950. The USAF had no problems with the high landing speeds of these new fighters because they could always add length to their already long runways as they had done when straight wing jet fighters entered service.

The Navy had pioneered the L-39 prototype program in early 1945 to determine if swept wing airplanes could have landing speeds compatible with carriers. The Bell L-39 was a USAF Bell P-63 Kingcobra which had the wings cobbled up with 35° of sweep and the tail planes cocked up to counteract the different pitching moments of the swept wings. Although the Navy tests found that they indeed could have good handling and low speed performance with swept wings, they did not take advantage of their knowledge as promptly as the USAF. This experimental propeller-driven airplane, however, lacked the low speed thrust performance of jet engines of the day so that the carrier suitability tests were not conclusive.

I had the privilege of flying both prototypes on 19 June 1946 and I found that their handling characteristics were acceptable for carriers of the period.

Grumman also lacked the incentive to get into the swept wing arena. Joe Hubert was Grumman's "captured German" who had been impressed into US industry after World War II. He had designed Luftwaffe airplanes with swept wings for Messerschmitt prior to the war and was the project engineer on the very famous Me 163 rocket fighter which had 35° swept wings. His and my desire for a swept wing aircraft was unheeded by the engineering department, which understandably had its hands full meeting Navy contractual commitments on the F8F Bearcats and upcoming straight wing F9F Panther jet series of airplanes.

After the "Battle of the Admirals", when the USAF tried to sink the Navy carrier program in Congress and the Navy tried to shoot down the B-36 intercontinental bomber program, the Navy belatedly started to get into the transonic airplane competition with the USAF. In the meantime, Russian swept wing MiGs were showing up regularly in their May Day demonstrations of military power because Moscow had listened to its "Captured Germans".

THE NAVY FOUR-PRONGED TRANSONIC FIGHTER PROGRAM

The Navy launched a four-pronged program, for sole source, uncompeted transonic Navy fighters. This resulted in the greatest pandemonium we had ever seen in the Navy fighter business. They contracted for the Douglas F4D Skyray batwing tailless design, the Chance Vought F7U Cutless swept wing tailless design, the Grumman F10F Jaguar variable sweep wing design, and the McDonnell F3H Demon swept wing standard design in rapid succession. One of these might have become a world class supersonic carrier based fighter if it hadn't been for the decision to equip all of these airplanes with grossly undeveloped Westinghouse jet engines, the J40 and the J46, both without afterburners! All of these airplanes needed an afterburner to get into the international supersonic race.

All of these airplanes had very limited production and less than outstanding operational experience and there were many tragedies. Fortunately, the Navy had the less exotic but operationally acceptable swept wing but subsonic Grumman F9F-6 Cougar and the North American FJ-3/3M Fury series of airplanes in quantity production. Both aircraft were developed from their straight wing predecessors and were a holding force for carrier aviation in the early 1950s during and after the gestation periods of the more exotic Westinghouse powered airplanes.

At right top, the wooden F9F-9 Tiger mock-up poses with an F9F-6 Cougar for comparison. The feeling that Grumman designed the smallest airframe possible around the contracted intended engine is evident. (Grumman)

At right bottom, mock-up viewed from above. Note the foreshortened nose and shape of the vertical tail, two areas of future redesign on the production aircraft. (Grumman)

THE NAVY SETTLES FOR SUPERSONIC TWO WAYS

In 1953, the Navy had two very important competitions for Navy producers that spearheaded Naval aviation and gave the Navy supersonic capability into the 1980s. These competitions finally selected the F8U Crusader for the standard day fighter role and the F4H Phantom II for the all-weather role. Grumman was a loser in both of these battles, probably because they were in full production of the F9F Panther and Cougar series of fighters and the two large production runs of the S2F Tracker and SA-16 Albatross, plus miscellaneous smaller aircraft programs. Although politics were blamed by the engineering department for losing these two juicy and lucrative contracts, I believe that the Navy considered us too busy with production and the other two contractors as being too low on future business. Grumman was not as lean and hungry as Chance Vought and McDonnell. There were also rumblings that Grumman top management thought that with ground-to-air missiles coming on, the day of the fighter was over. This surely lessened the necessary corporate resolve to win those two competitions.


NAVY
NAVY

Above, below and at right, the first Tiger prototype designated F9F-9 prior to its first flight. Note the configuration of the wing fence and the lack of intake boundry layer splinter plate. (Grumman)

Below Grumman's top management there was plenty of pressure to stay in the fighter business. Grumman always had two competing engineering departments: Experimental, headed by V.P. Bob Hall, and Production Engineering, headed by V.P. George Titterton. George was the driving force behind developing any production airplane that the Navy might find useful. This was why the F9F series had progressed as far as the F9F-7. Bob Hall (and Dick Hutton, who was in charge of Preliminary Design) competed with him internally by designing new airplanes. The Navy was always the beneficiary of these competitions.

The F9F-8 Cougar with its increased wing area, fuel, and external stores racks appeared to be the last variant of the Panther series that the Navy would accept. Although Grumman management did not know it, there would be a total of 1198 F9F-8s in future Navy procurement: 595 F9F-8s, 148 F9F8Ps, & 455 F9F-8Ts. By 1953 all facets of airframe and engine state-of-the-art had progressed too far for Grumman to keep pushing a 1946 design.

THE NEW TIGER STEPS IN UNOFFICIALLY

The Navy and Grumman knew that although McDonnell and Chance Vought had straight-wing jet production background in the Phantom I and Pirate programs, neither had built supersonic airplanes with complex avionics and missiles. The McDonnell F4 would also have the untried General Electric J79 engine in a new

airplane. The Navy knew that both airplanes would require extended development times, however optimistic the contractors' programs were. Grumman officials also knew that the high production Cougar program also had a very big and many pocketed budget. Putting both of these premises together, Grumman management decided to put a top design team together and interject a sole-source, interim, simple, small, supersonic, state-of-the-art day fighter with a known engine to put the Navy in the supersonic arena long before the F-8 and the F-4 could enter squadron numbers. The Navy relied on Grumman's "sterling" reputation for production ability earned by the WW II Hellcat and the hidden Cougar funds to make the project go. Joe Gavin and Larry Mead, two top-notch engineers who could get anything done at Grumman, were named project and assistant project engineer and told to pull anybody needed into their group to "make it happen"!

Breaking from Grumman tradition, exceptionally thin wings were designed, thinner than those of the Bell X-1 supersonic research vehicle. These were milled from aluminum planks rather than being made of conventional metal construction. The Whitcome NACA Coke-Bottle formula was used on the fuselage for the first time to give the airplane a predicted 25% reduction in transonic and supersonic drag. The team selected the axial-flow Curtiss Wright J-65 engine, which had flown reliably in hundreds of North American FJ Fury

Below, the first F9F-9 BuNo 138604 wrapped in canvas for security reasons and loaded on a flatbed truck for its 61 mile ride from Grumman Bethpage to Grumman Calverton, New York. Although there were great concerns about the trip, it was made in 3 hours without an incident. (via Corky Meyer)

Above, Corky Meyer taxiing back from a high speed taxi/lift-off on 28 July 1954 prior to the first flight.. The wing fences extended around the leading edge of the wing. These were shortened after the first flight when it was found that they were no better than the ones that stopped 8 inches behind the wing leading edge. As a safety measure, the hook was in the extended raised position in case it was needed to arrest the Tiger in case of an emergency. Once extended, the hook could not be retracted from the cockpit, it could only be raised or lowered. (Grumman via Corky Meyer)

series and Republic F-84F production airplanes. We wanted to put a state-of-the-art, but not an untried, engine in our new airplane. This was a very prudent selection for shortening development time, or so we thought at the time. We had failed to take into account that: Curtiss Wright engines had always spelled trouble and that this was their first jet engine, and they had never designed, built or tested a jet engine afterburner. This last item is important because an afterburner is not an off-the-shelf item bolted to the back of the engine. An afterburner has great pressure, temperature, and airflow interactions on the engine ahead of it, and they both have to be tuned and tested to each other's influencing eccentricities.

Once firmed up, Grumman sold the idea to the Bureau of Aeronautics and on 26 April 1953 the Navy ordered three prototypes. They now would have their simple supersonic fighter. It would be their ace-in-the-hole in case the F-8 or the F-4 stubbed their toes.

After the loss of face in losing out in the last two fighter competitions, Grumman was back in the fighter business with the F9F-9. As one

Above, Joseph Gavin, Jr., Tiger project engineer. (Grumman)

Below, Corky Meyer taxi tests the first Tiger, F9F-9 BuNo 138604, prior to the first flight. (Grumman)

might expect, it was easy for the Navy to find the money for this development in one of Grumman's other pockets, the high production F9F-8 Cougar program. It is difficult to believe that a totally new airplane program could have been launched at the Navy Captain level in the Bureau of Aeronautics when all new programs today are decided at the Presidential level.

DESIGN CONSIDERATIONS

I was selected to be the Tiger project pilot. I went to Edwards AFB to fly the Republic F-84F and to the Naval Air Test Center at Patuxent River, MD, to fly the FJ-3 Fury, both with J-65 engines, but without afterburners, in order to become familiar with the engine's eccentricities. The first J65 I saw was one that had had some Foreign Object Damage (FOD) to its aluminum compressor blades. All 650 blades had broken off and they never did find the foreign objects that had caused the problem. It looked like a corn cob that had been stripped by a very enthusiastic eater. I was told that the USAF and the Navy were going to redesign the compressor blades so that the first three rows of both the rotor and stator blades would be made of steel, thus making the FOD problem almost go away. Before I flew the Republic F-84F, Carl Bellinger, Republic's Chief Test Pilot, was kind enough to tell me that the J-65 engine also had the bad genetic trait of greatly changing its normal vibration frequency in flight without changing airplane attitude or throttle position. I found this to be true on my first flight in both airplanes. It was to become a source of nervousness to Grumman pilots because all of the many other engines that we had flown had no such trait. One of my Navy friends who had flown the J-65 in the North American FJ Fury series succinctly said that, "The J-65 has night noises in the day time!" Except for FOD damage susceptibility, the J-65 had a great name in both the USAF and the Navy as a very reliable engine. The only small engine problem we at Grumman foresaw was that ours was to be the only airplane requiring the undesigned and undeveloped afterburner to make our Tiger supersonic.

Above, deployed speed brakes during the first flight of the F9F-9 Tiger. Note the original square forward fuselage speed brake. Ralph McDonnell was flying Cougar chase for Corky Meyer (Grumman).

Our primary airplane problem was that the transonic region

Below, first flight of F9F-9 138604 on 30 July 1954. (National Archives)

between Mach number .95 and Mach number 1.05, and to a lesser amount the ensuing mach numbers, were still considered witchcraft as far as performance predictions were concerned. The reason was that wind tunnel test throats where the airplane models were suspended were relatively small because of the very great power needed to create and sustain supersonic wind speeds in them. Thus they would only take small models which had large unknown scale effect. The problem was that shock waves, as they formed, would bounce off the walls of the small throat tunnels and back onto the model making the accurate measurement of transonic and supersonic data impossible. We were going to be in the dark as much as the North American and Convair performance aerodynamicists were when they designed the F-100 and F-102, which on their first flights had much less supersonic performance than they were supposed to have. Both airplanes wouldn't even go slightly supersonic until major changes were made in their designs and their afterburners developed an additional 1,220 pounds of thrust.

The F11F Tiger was designed to attain 1.21 Mach in level flight. we would find all too soon that we were no better at this supersonic estimation witchcraft than all of our peers in the industry.

Although I had other flying chores to do during this time, I was considered a member of the team and was cut in on all decisions. The only other unknown that the Tiger might have was the change in trim caused when the landing gear retracted into the fuselage and swiveled its wheels in the airstream just ahead of the stabilizer. So we planned on sufficient altitude for the first retraction to ease that worry. Other than in the cockpit, I insisted on only one change in the general design. The fuel system had two fuel tanks, one forward and one just aft of the center of gravity. The engineers decided that it would be a great idea to make the use of these tanks selectable so that the center of gravity could be changed in flight. They considered the pilots to be infallible in remembering to change the selector back to the fullest tank before the tank in use emptied and the engine flamed out. I must have disappointed them when I required an automatic change over system be fitted. I knew that I could get so engrossed in my work that I could easily forget. I did not want to experience an unintentional flameout if I could help it, because some jet engines had very difficult air start procedures, especially at low altitude. The system was modified prior to first flight and all went well. I was not to know how much prescience I had that test pilots sometimes had short memories. The exact same fuel system was used a few years later in the twin engine Grumman A-6 Intruder but without the automatic switchover system. The test pilot had a double flameout at low altitude. He was a very lucky fellow in that he finally restored power just as he went through some tree tops way out in the boondocks.

THE TIGER FLIES, 30 JULY 1954

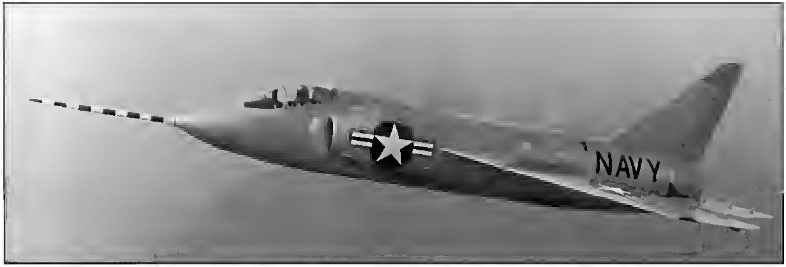
The Tiger completed its ground tests early on 24 July 1954. Although Grumman usually did first flights without any notice to the outside world, we somehow had many Washington Navy people who were interested in seeing the Tiger's first flight. The weather was most uncooperative, however, as the sun could be vaguely seen through a cloudless but very hazy sky. The Navy still wanted me to get on with it. I checked the weather in a Cougar several times and at three thousand feet I couldn't see the ground and the top of the haze was over 20,000 feet. As the day progressed, the haze became even more dense. The next day it was the same thing although it looked great from the ground and my Navy friends kept the pressure on. It was my policy and the company's that we have clear and unlimited ceiling for a first flight. In case anything went wrong, the pilot would not be too far from base to be able to point the airplane homeward immediately. Finally, Jake Swirbul, the President and a founder of Grumman, could see the pressure the Navy was giving me so he suggested that they return to Washington and that I would fly it when the weather was ready.

Finally, on Saturday of that week the weather cleared and we made two flights back-to-back without any trouble at all, even with the possible recalcitrant landing gear. On the second flight we exceeded Mach one and went supersonic in a shallow dive! We did have an unexpected problem when I got to 40,000 feet on the second flight after exceeding Mach one, when I reduced the engine power enough to descend. The engine started having duct rumble and then made loud noises as if it were backfiring. This was not predicted, nor was the very high aircraft buffeting when I opened the speed brakes to check their effect at high altitude and Mach number. With the engine power retarded to the lowest backfiring I could stand and the speed brakes extended to the maximum buffeting I felt the structure could stand, I could only make a very slow let down. I then became concerned about running out of fuel before I got to the ground.

We put much bigger hinge gaps on both speed brakes which eliminated the terrible bufteting, but it took us several more flights to locate the engine backfiring problem which was caused by the blunt contour of the air intake. Contoured knife-edge engine air intake duct splitter plates were added to solve the problem.

After two weeks of opening the flight air speed envelope, we decided that it was time for us to put on a high speed demonstration for the Navy and the public. We invited the Navy brass, the news media and a large number of Grumanites. The airshow must have been a great success as the Navy increased their orders for the airplane from 41 to 388 shortly thereafter.

In the next two months, the final speed/G build-up flight test structural program for the non-afterburner airplane was completed. The airplane was now cleared to 1.3 Mach number at altitude, tapering to Mach 1.0 from 10,000 feet to sea level. The G was



increased to 7.5, or to the buffet boundary whichever occurred first at all altitudes. This also included full lateral stick rolls and full rudder pedal deflections at all altitudes. To get ready for the first NPE (Naval Preliminary Evaluation), we spent a lot of time tailoring the landing condition and stall characteristics to ensure a docile carrier airplane. Grumman always liked to have an NPE as soon as possible after the first flight so the Navy could help us solve problems that they had possibly encountered testing other contractors' aircraft.

THE ALMOST FATAL NAVY NPE

On 20 October 1954, CDR Marsh Beebe, Director of the Flight Test Division, and CDR Tag Livingston came up from the Naval Air Test Center at Patuxent to evaluate our new bird. They flipped a coin and Tag got the honor for the first Navy flight. His evaluation would be within the flight envelope that we had tested, but he was to perform a new but very unsuccessful test in the Tiger with only twenty minutes familiarization flight time.

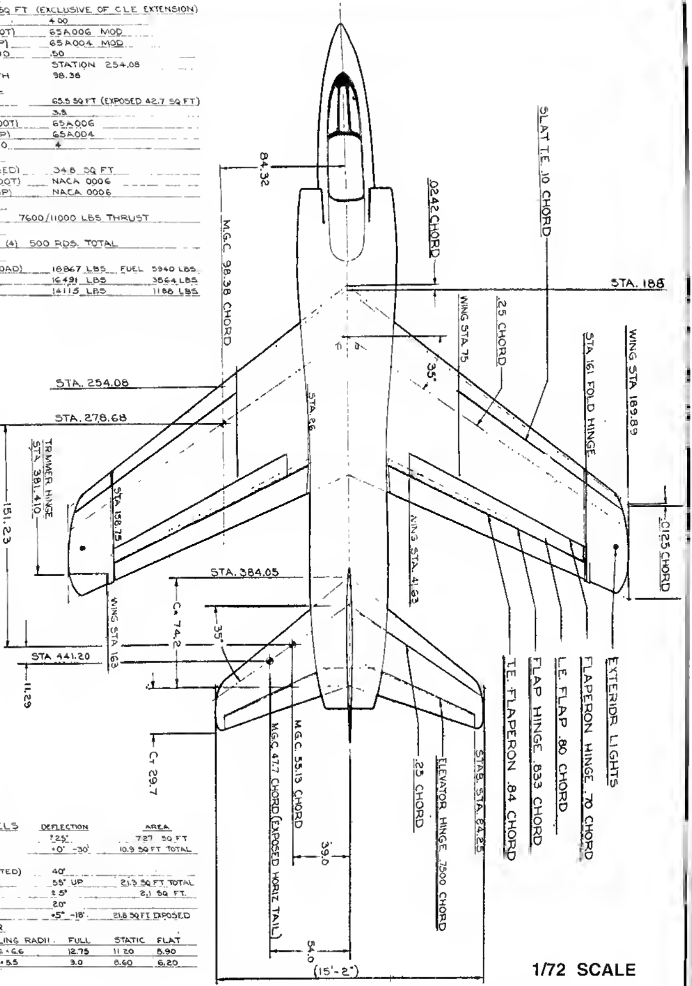
He flew the number one Tiger and coincidentally I flew the second Tiger at the same time. During my flight, I inadvertently heard him say that he had had a flameout and was descending over a small paved airport southwest of Grumman while he was trying to get an airstart. I happened to be over that same field, and soon I saw him spiraling down with his landing gear and flaps extended with a great rate of descent. For the first time in my life I couldn't think of what I should say to him that would help. I knew he had his plate full trying to get the engine started and planning for a flameout landing in a new airplane at an unfamiliar field. Finally, just as he started his final 180° turn, I "ordered" him not to let the air speed drop below 135 knots because I knew that was the minimum controllable speed at his aircraft weight. He said nothing, swung too wide of the landing strip, went into the scrub pine and disappeared without an explosion. I figured he was a goner and called the field to tell them to send an airplane over to get his body. I flew home in a state of shock. Less than ten minutes

Above, the number one Tiger with the first intake duct splitter plate. This plate had a very sharp bevel as can be seen. This installation proved to give no better duct performance than without the splitter until we ground the bevel off to make a knife edge all the way to the duct entrance. It then gave satisfactory duct performance at all powers and altitudes. (Grumman via Corky Meyer)

Below, the number four F9F-9 138607 with the knife edge splitter plate that eliminated duct rumble and became standard on the Tiger series. (MFR)

GENERAL ARRANGEMENT F9F-9 TIGER

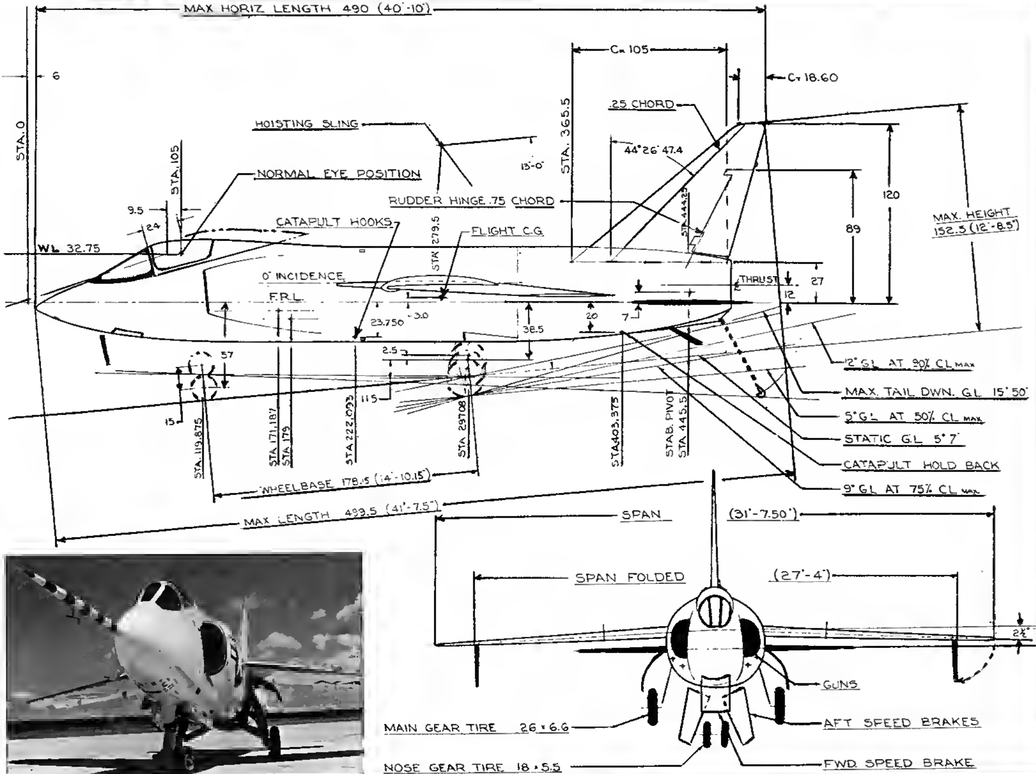
WING		
S_w	250 SQ FT (EXCLUSIVE OF C.L.E. EXTENSION)	
A.R.	4.00	
SECTION (ROOT)	65A006 MOD	
SECTION (TIP)	65A004 MOD	
TAPER RATIO	.50	
L.E. M.A.C.	STATION 254.08	
M.A.C. LENGTH	98.38	
HORIZONTAL TAIL		
S_{HT}	65.5 SQ FT (EXPOSED 42.7 SQ FT)	
A.R.	3.5	
SECTION (ROOT)	65A006	
SECTION (TIP)	65A004	
TAPER RATIO	.4	
VERTICAL TAIL		
S_{VT} (EXPOSED)	34.8 SQ FT	
SECTION (ROOT)	NACA 0006	
SECTION (TIP)	NACA 0006	
POWER PLANT		
J65-W-6 (1)	7600/11000 LBS THRUST	
ARMAMENT		
MK12 20MM (4)	500 RDS. TOTAL	
WEIGHTS		
T.O. (OVERLOAD)	18867 LBS	FUEL 5940 LBS
COMBAT	16491 LBS	3564 LBS
LANDING	14115 LBS	1188 LBS



SURFACE TRAVELS	DEFLECTION	AREA
RUDDER	±25°	7.27 SQ FT
ELEVATOR	+0° -30°	10.9 SQ FT TOTAL
FLAP (SLOTTED)	40°	
FLAPERON	55° UP	21.3 SQ FT TOTAL
TRIMMER	±5°	2.1 SQ FT.
SLAT	20°	
STABILIZER	+5° -18°	21.8 SQ FT EXPOSED

ALIGHTING GEAR	ROLLING RADII	FULL	STATIC	FLAT
MAIN TIRE	26 × 6.6	12.75	11.20	8.90
NOSE TIRE	18 × 5.5	9.0	8.60	6.20

1/72 SCALE


MAX HORIZ LENGTH 490 (40'-10")
STA. 0
6
Cr 105
Cr 18.60
.25 CHORD
44°26' 47.4
STA. 365.5
HOISTING SLING
13'-0"
STA. 105
NORMAL EYE POSITION
RUDDER HINGE .75 CHORD
STA. 444.25
9.5
24
CATAPULT HOOKS
STA. 279.5
FLIGHT C.G.
WL 32.75
0° INCIDENCE
F.R.L.
THRUST
27
12
120
89
MAX. HEIGHT
152.5 (12'-8.5")
23.750
3.0
38.5
20
7
2.5
57
11.5
15
STA. 119.875
STA. 171.187
STA. 179
STA. 222.093
STA. 297.08
STA. 403.375
STAB. PIVOT
STA. 445.5
12° GL AT 90% CL MAX
MAX. TAIL DWN. GL 15°50'
5° GL AT 50% CL MAX
STATIC GL 5°7'
CATAPULT HOLD BACK
9° GL AT 75% CL MAX
WHEELBASE 178.5 (14'-10.15")
MAX LENGTH 499.5 (41'-7.5")
SPAN (31'-7.50")
SPAN FOLDED (27'-4")
2½°
GUNS
MAIN GEAR TIRE 26 × 6.6
AFT SPEED BRAKES
NOSE GEAR TIRE 18 × 5.5
FWD. SPEED BRAKE

Above, ADM Apollo Souchek congratulating Corky Meyer on his demonstration of the number one Tiger on its eighth flight during the Grumman public demonstration on 12 August 1954. (Corky Meyer)

Above, after the 8th flight, Corky Meyer talks with ADM Apollo Souchek, Chief of BuAer; Le Roy Grumman, Chairman of Grumman; Jake Swirbul, President of Grumman; and Joe Gavin, Project Engineer. (Corky Meyer)

later the rescue airplane landed to meet Tag walking out of the scrub pine in a daze but with only minor injuries. He later told me that he heard my admonition very clearly and thanked me for that last minute advice. We never did find out why his engine didn't start because the igniters were so damaged that they were unworkable.

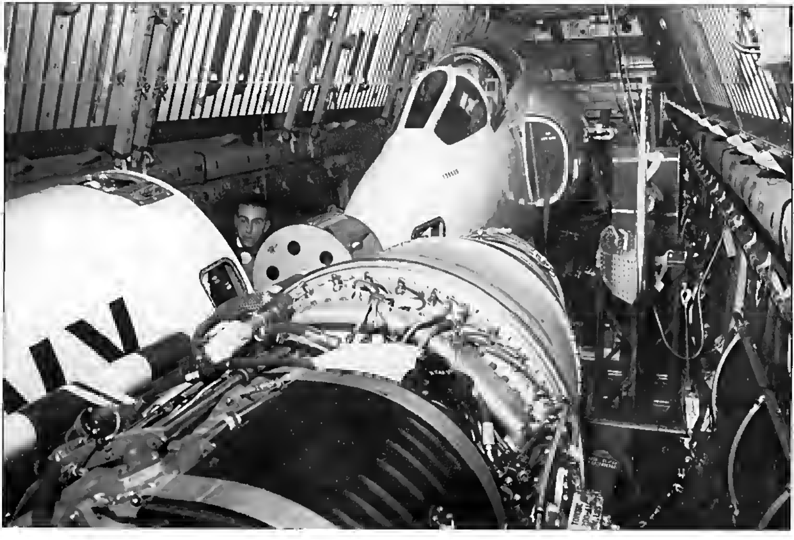
Below, the number one Tiger prior to its 4th flight after it had come out of the paint shop and completed its instrumentation checkout. The rows of silver dots on the fuselage and fin are pressure pickups all over the fuselage to make measurements to find out if the Whitcomb area rule idea was as good as the windtunnel suggested it would be. We took some data in supersonic dives prior to the first NPE when it crashed for a total loss. We never did get enough data to make the determination. Note the non-afterburning tailcone configuration on the F9F-9. (Grumman via Corky Meyer)

FLAMEOUT TESTING AT EDWARDS AFB

Below, the number two Tiger was transported in a Douglas C-124 Globemaster on its trip to Edwards AFB. (Corky Meyer)

We decided to take the second airplane to Edwards AFB immediately to determine why the engine didn't start and find out just what were the air restart altitude, airspeed, and techniques limits for the Tiger airplane/engine combination. After Tag's unhappy episode, it took a lot of self persuasion for me to make the

Above, the final resting place for the number one Tiger. CDR Livingston was shooting an emergency landing on the abandoned Brookhaven airport runway. Although he didn't make it, he walked out of the woods with only a lot of bruises and a very sore back. The trees that his wings cut down were six inches in diameter. (Corky Meyer)



Above, after the loss of the number one Tiger with its very sophisticated pressure measuring system for the entire fuselage of the aircraft, we had to revert to the old fashioned way of tufting the airplane with short yarn pieces taped to the skin of the airplane. A chase pilot could see the air flow at all flight conditions. The main reason for tufting the wing was to determine the flow condition in the take off and landing condition to show the increased turbulence of the air flow as the airspeed is decreased to the wing stall. This was done on the number four Tiger. (Grumman via C. Meyer)

first intentional flame out even over the ten-mile diameter lakebed at Edwards! It did not take many flights to determine that we had a satisfactory air start altitude and airspeed envelope. Because the Edwards lakebed runways were available, we prudently decided to perform some intentional engine-off landings to see that all of the control systems had sufficient hydraulic boost power to be able to maneuver the airplane in rough air near the ground with the engine and engine driven hydraulic boost pumps windmilling slowly at landing airspeeds.

On my first engine-off landing I hit some rough air as I flared out and before my stick motions had the airplane at the correct landing attitude again all three of the controls froze up. I was immediately riding instead of flying. The airplane bounded back in the air and bounced wildly two more times before coming to a stop. It was a very helpless feeling. I thanked my lucky stars for the Edwards lakebed runways. It would have been a disaster if this maneuver had been performed at the Grumman airport. Although he was probably much too occupied with his off-runway landing in the scrub pine, I always had the feeling that Tag had his controls freeze up at the last minute too. We changed the two 7 gallon per minute hydraulic pumps for 14 gallon per minute hydraulic pumps and the controls worked very well even with much overcontrolling on several engine-windmilling landings. We also tested the Tiger landing with the engine shut down completely and the Ram Air Hydraulic Turbine extended, providing the only power source for the flight controls. It performed up to design standards.

J65 AFTERBURNER DISASTER

During this same set of tests we had the first scheduled experimental afterburner shipped to Edwards. Hopefully, this would provide additional safety in case of a forced landing or bailout. We were also looking forward to the fifty percent increase in thrust that would greatly improve the inadequate rate-of-climb and high speed performance of the Tiger. For the first test I went to 35,000 feet to see how rapidly this 50% increase in thrust would accelerate the airplane to its contracted 1.21 Mach number supersonic speeds.

The first time I lit off the afterburner the airplane started accelerating, but not nearly as fast as other air-

At left, the extended slat was finalized for production and the fence was shortened to accomodate the slat extension. The slat was not extended into the fuselage because it was to have the 60°wing fillet also installed. This reduced the stall speed by 5 knots. 5 knots sounds like a very small improvement, but it does give the pilot a greater leeway for his carrier approach and improves catapult flying speed margins sufficiently for production installation. (Grumman)

planes I had flown with afterburners. The F-100 would give you a belt in the backside and the airplane would promptly accelerate through Mach one and not stop until 1.25 Mach. I waited as the speed rose very slowly from .92 Mach to about 1.03. There was then a violent explosion in the airplane. I immediately throttled back out of the afterburner detent to shut the burner off and assess the damage. My chase pilot reported that a very large ball of fire came out of the back of the engine and he heard the noise from his airplane about 100 yards off my wing. He said that my airplane looked undamaged so we landed immediately. We found that a sizable hole had been burned through the side of the afterburner shell continuing through the fuselage stainless steel outer protective shell and eating into the fuselage aluminum just over the fuel tanks. This was neither the first nor last time I found that shutting down as much of the power as possible, declaring an emergency and landing as soon as possible is very prudent flight test policy.

Because this was the first experimental afterburner that Curtiss Wright had designed or constructed we knew that it would be months before they would have an improved and tested model to Grumman. We packed up and flew the airplane back to Grumman's Calverton New York test center.

GRUMMAN'S EDWARDS SUPERSONIC TEST EDUCATION

Because there were so many of our competitors flying at Edwards, I made it a policy to find out what they were doing that might be applicable to the testing that I was doing or planning to do. I found both the military and the contractor test pilots most generous in informing me of the details of their programs. These were the golden years of testing at Edwards. There were ten airplane and engine contractors there. The USAF was testing at least 20 different aircraft, including the Century series supersonic aircraft, and including the ultra-high-altitude U-2 secret spy plane flying visibly at the North Base. The NASA High Speed Flight Station was also there with all of the many X aircraft flying often. It was a college education in high speed flight testing!

While I was testing the Tiger at Edwards, George Welch, the North American F-100 chief test pilot, was killed doing limit speed dives at slightly over 1.5 Mach which was well over 1,000 miles per hour. On his last dive he pulled over 9G, the airplane skidded sideways to over 15° of yaw, the fuselage broke at the cockpit, and the airplane disintegrated instantly. The reason for this was twofold. To get more speed, the North American engineers had designed a much smaller fin and rudder to reduce the drag. As the supersonic Mach number increased the directional stability decreased, because of the shock wave effect which blanked it out. This caused the huge angles of yaw that were recorded. The other factor that contributed to the accident was that the data reduction people were over

Above and below, the #4 Tiger F9F-9 138607 showing the wing slat extended to the tip of the wing. It was determined by tuft tests that the portion of the slat that was on the folding tip was not controlling the wing tip vortice flow enough to be worth their presence. For this reason and the reduction of complication of manufacturing, they were eliminated from further production aircraft. The wing fences have also been removed for testing. The tests showed that the fences were needed to keep the stall characteristics docile, so they were reinstalled. (Grumman)

ten flights behind. George was going into a completely new region of flight testing without anyone knowing what was happening. I cannot imagine why George didn't note and complain about the yaws that he had encountered on previous flights. When I did some of these investigative flights a month later in the Tiger, I got to yaw angles of 5° in pullups and I thought that I was flying sideways. After the accident, North American installed a fin and rudder that was over twice the area, and flight test engineering took a much greater interest in the detailed progress of limit speed determination. The F-100 with the increased area had over twice the directional stability and no further problems were encountered at limit speed. North American provided me with enough data from their flights that Grumman immediately started to design a fin and rudder of much greater area to preclude this happening to the Tiger. They also stopped the limit speed investigations until a redesigned fin and rudder could be installed.

THE SPEED "G" AND ALTITUDE BUILD-UP PROGRAM

When we brought the Tiger home from Edwards, the instrumented replacement Tiger for the one that crashed was completed. Limit speed tests were resumed to open the speed/altitude envelope in dives as far as the non-afterburning engine power would allow.

This program had gone 10 flights without an incident until we were approaching the highest airspeed and Mach number combination to date, which was Mach 1.1 at 7,500 feet altitude. Without the afterburner, this dive would have to be at a 45° angle and combined with a 7.5 G pullout. It would make the bottom altitude of the dive a safe 5,000 feet. Remember Mach 1.1 at that altitude was 825 mph and the rate of descent was over 1,200 feet per second. The ground was only 4 seconds away from the bottom of the pullout. I was soon to find that such a short time period would not allow much time for unanticipated mental agility.

I started the dive at 22,000 feet and attained Mach 1.1 at 16,000 feet altitude. My program was to jolt the stick twice longitudinally and laterally to see if flutter ensued, apply full rudder pedal releases in both directions to check directional stability and then pull 7.5Gs at 7,500 feet. All went well until about a second before I went through 7,500 feet when a very loud explosion occurred and the cockpit filled up with hydraulic oil mist. I couldn't see the instrument panel. I immediately pulled the stick hard aft to pull out of the dive to gain as much altitude as possible, slow down, and to determine what the hell happened. The next thing I noted was that I was going up vertically and the speed was decreasing rapidly. The cockpit vent system slowly cleared the mist in the cockpit and I frantically noted that if I didn't push over to level flight very soon I would go to zero speed G in a vertical condition and stall. I pushed over to about a negative 2 Gs, finally leveled at 15,000 feet and noticed that I had instinctively retarded the throttle to idle sometime before. I eased the throttle forward and looked around for CDR Don Walton, who was my chase pilot flying an F9F-8. He was nowhere to be seen. It didn't occur to me that my violent pullup wasn't on the program. He told me later that I instantly disappeared. I then noted that I had pulled 9.2 G on the accelerometer. Immediately after that the engine began to run very roughly. I tried to locate Don but there were clouds over the area and he never did find me. I wanted him to give me a look over to see if he could find out what damage the explosion had done to the airplane. I also wanted him to point me back to the field as the clouds were getting denser and we were still ten miles out over the Atlantic Ocean.

My engine began getting slowly but progressively rougher as I cruised in a direction towards the Calverton airport. Each time it got rougher, I

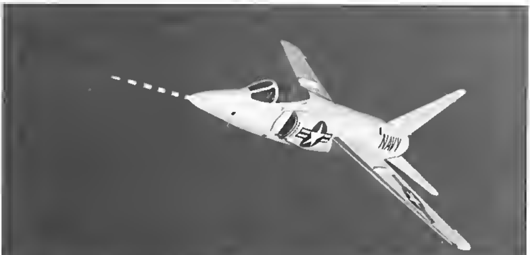
The 5th prototype Tiger, BuNo 138608, later in the test program after its designation had been changed to F11F-1, is seen at Edwards AFB during an open house in 1955. The aircraft was overall white with a natural metal lower rear fuselage.The nose probe was white with red stripes and the leading edges were natural metal .(William Swisher)

pulled the throttle back just enough until it smoothed out. I then noted that I was over the south shore of Long Island and on a course that would bring me over the field. The engine got rougher much faster with time and I retarded the throttle a little more. The speed was slowing down so I let the engine stay as rough as I could tolerate. I finally arrived over the field and I was down to 180 knots airspeed which was the best glide speed for a flameout landing pattern. The roughness of the engine died down, and as I moved the throttle forward I found out that it had quietly died. It is always good to keep the engine running as long as possible. I had declared an emergency, so I had the field all to myself. I extended the wheels and flaps and set up the flame-out pattern for sure now. I kept the speed until I was on a very short final and flared out for a landing. When I got close to the runway, the airplane, being about 60 knots over the landing speed, kept flying with the airspeed decaying at a rate that made me think that the engine was still running. I pulled at the throttle but it was against the rear stop. We had an arresting cable across the middle of the length of the runway, and when my hook picked it up at 170 knots and decelerated me to a stop in about 300 feet I was very pleased for small favors. I would have surely gone out the other end of the field with blown tires if the cable had failed.

Inspection after the flight showed that the emergency hydraulic ram air turbine which was located right under the cockpit had come unlocked by itself, extended into the airstream and torn off the airplane. When it ripped off it disconnected the hydraulic lines and that's where the hydraulic oil mist came from right after the explosion.

The 35 pound turbine had scored the side of the fuselage and made a big dent in the left hand stabilizer. Had it gone 6 inches lower it would have torn off the entire left hand stabilizer. We looked into the engine air ducts and saw a several square feet of aluminum debris from the fuselage skin cover of the departed hydraulic turbine pump blocking the air to the

Four in flight views of F11F-1 138608 with production splitter plates, reshaped and lengthened nose cone, non-afterburning engine, and prototype vertical tail fin. Four 20mm cannons have also been added, two on each side on the lower side of the jet intakes. (Grumman)



Above, Corky Meyer stands in cockpit after a flight in a early prototype Tiger. (via Don Spering)

engine. but the real culprits contributing to the engine's demise were the two, three-pound steel up-locks to the hydraulic turbine that had been spinning against the front 90 engine rotor blades like balls on a rotating roulette machine. They had almost completely eaten through the blades. That was what was causing the engine to slowly die on me. If the air is disturbed on the front set of rotating turbine blades, all the ones behind them have very badly spoiled aerodynamics for proper jet engine performance.We also found out that the locking mechanism did not conform to the drawings. The pull handle in the cockpit for emergency operation was not spring loaded in the closed position as it should have been. It somehow vibrated open on this flight. The ram air turbine was completely redesigned and flight-tested properly to the limits of the Tiger flight envelope very soon thereafter, but it was to fail catastrophically in flight again.

TIGER SPIN TESTS

The Navy has long-established standards for flying qualities which must be demonstrated in all fighter aircraft to be procured. Among these requirements are those for recovery from 5-turn clean condition upright spins, 2-turn clean condition inverted spins and one-turn upright spins in the landing configuration. They were all to be performed both to the right and left. Counting build-ups, completing this program should take 40 to 60 spins and recoveries. The specification allowed these spins to be performed with the engine at idle power. Clean condition spins also were required to be performed with full power for one turn prior to recovery. Because our previous experience in the Panther/Cougar programs had shown that spins in jet aircraft were much more docile and less oscillatory than in propeller driven fighters, we thought that spins in the tiger would be a pushover. They weren't!

NASA has a spin tunnel in which small scale models of specific airplanes are tossed into the vertical shaft of air with controls in the pro-spin position. The airplane then spins a set number of turns, a timer puts the controls in the anti-spin position, and the airplane theoretically recovers. They record the data and present it to manufacturers to instruct them in their spin programs. Their tunnel has been operating for years and a lot of good has come from their efforts. My experience was that as the wing loadings of fighters went up, the results of their wind tunnel tests became less reliable. If their report said that the recovery was not so good we would be concerned about full scale tests. If the results showed that the spin recoveries were good, our concerns would be the same. The NASA tunnel results showed that the F11F-1 Tiger would have good spin recovery characteristics.

It was Grumman policy to restrict rudder and elevator angles to the minimum necessary for all air maneuvers in order to keep the spin as docile as possible and to have rapid recovery characteristics. On one of the first flights of the Tiger , I noted that the rudder authority in the clean configuration was much more powerful than it needed to be for any flight maneuver the airplane would be required to perform. Accordingly, we reduced the excess rudder angle from 30° to 10°. However, the airplane did need 30° of rudder angle for the landing configuration because of the high adverse yaw of the swept wing at low speeds, so we fashioned a device that increased the rudder angle beyond 10° when the flaps were extended.

As a safety measure, we always installed a 10-foot diameter anti-spin chute in the tail of the spin demonstration airplane in place of the normal tail hook. It could be used by the pilot if the airplane showed any prolonged indifference to recovery. When the chute came out and opened, its immense drag caused it to yank the airplane out of its highly yawed and pitched attitude into straight flight. After the airplane recovered, the spin chute had to be released from the airplane because the drag was so high when it was open that the airplane couldn't fly, even with full power. I had used one "in anger" doing the Bearcat spin program. It worked then and I became a believer.

A VERY, VERY WILD SPIN

All required spin configurations

were done with the final big fin and original rudder and were demonstrated without any abnormal characteristics. The recoveries were within one turn in all situations and we knew this would be acceptable to the Navy. The spin chute was removed because of a very high frequency and most annoying vibration at all transonic speeds at low altitude. After trying several changes to the rudder control system without improvement, we heard from the Navy that another contractor had cured this problem by thickening the trailing edge of the rudder to 1.5 inches from its normal knife edge. It cured the buzz on the first flight. A week or so later one of the engineers said that we would have to repeat the spins because any change in a control system required a redemonstration. He also suggested that the change was so small, the spins could be performed without going to the trouble of reinstalling the spin chute. Because of my Bearcat experience I disagreed, and the anti-spin chute was promptly re-installed.

The first spin that I performed was entered at 20,000 feet. The airplane went wild on the first turn after the spin entry. It started massive oscillations about all three control axes. The accelerometer showed from plus 4Gs to minus 2Gs, as the airplane rolled violently between plus or minus 60° bank angle and it yawed plus or minus 20° sideways!! This was the most sudden and violent maneuver that I had ever experienced in any airplane. This one lost me mentally in the first few seconds and physically several seconds thereafter. I felt that I was going to pass out because my eyes were graying out rather rapidly. Just before I lost consciousness, I instinctively reached for the anti-spin chute handle and deployed it. I didn't even think to try any recovery techniques. (I only found out that I had applied opposite rudder and stick to stop the spin when I saw the time history of the recorded flight data later.) I came to and found myself at about 12,000 feet hanging straight down over the frigid Long Island Sound with the anti-spin chute deployed. I didn't remember anything after the first turn of the spin or the recovery. After I recovered the airplane to level flight I released the anti-spin chute from the airplane and returned to base really shook up.

The only way I could appreciate the unbelievable aerodynamic flight limits the airplane reached during the spin was that this data was recorded on the instrumentation in the airplane. I had done hundreds of spins in my testing career. I had become used to unexpected and unorthodox spin gyrations and was easily able to mentally record the maneuver as it progressed, but I had never experienced anything this violent before except in two crashes.

Even after scrutinizing the flight records very diligently, we couldn't find any reason why the airplane went so completely out-of-control. We even rechecked the control surface deflections to see if they had been set properly, and found them to be correct. Nobody had any idea of what to do. Neither NACA or any of us had ever heard of any airplane with such obstreperous spins. Going back to basics, I decided to make a flight to check the directional stability and damping to see if any change had occurred with the thickening of the rudder trailing edge. Surprisingly enough, my flight proved that the trailing edge change had made the rudder twice as powerful as the original rudder! We then reduced the rudder angle to 5° in the clean configuration and set out to redemonstrate the spin program.

Needless to say, I was very apprehensive during the climb to altitude on the next flight. I was not fully convinced that the problem had been cured with one of the smallest changes that we had ever put on an airplane. I was hyperventilating somewhat thinking of what might still happen. I decided to start these spins at 30,000 instead of 20,000 feet, just in case. When I tried to set up the conditions for the first spin I couldn't get the engine speed, the start altitude, and the spin start airspeed into focus at all. Normally, setting up these conditions was second nature and took no time at all. I had tried several times when my chase pilot asked me why I was floundering all over the sky. I told my chase pilot to mind his

Below, the all-white third prototype, BuNo 138606, as seen from above with the right wing spoiler deployed. (via Naval Aviation Museum)

own business and that I would get it straight shortly. After another few tries, the ground radio monitor, whom I had worked with for many years, noted the change in my attitude and voice. He very diplomatically and propitiously asked me to check my oxygen breathing system. When I checked the blinker which opened and closed with each breath, I noted that the blinker eye was not moving. I checked the oxygen pressure and found it to be ok. I then looked at my mask connection and found that I had forgotten to hook it up.

I connected it and started to feel somewhat better, so I tried another spin entry and found that I was still befuddled. I decided to return to base as I well knew the lasting effects of anoxia. My chase flew formation with me, and when we came over the field in formation to the overhead break spot, I left him but found that the airplane somehow wouldn't slow down. I set up another approach and it still wouldn't slow down. My chase pilot suggested that I use the speed brake and retard the throttle. I then realized that I was functioning very poorly, so I asked him to fly formation on me for the entire landing pattern advising me as he saw fit. With his help the landing was anticlimatic.

The next day I tried again without any apprehension, and the airplane spun properly in all configurations.

The final demonstration at the Naval Air Test Center went smoothly except that I was asked to do several new types of vertical spin entries that had proven to give different spin and bad recovery characteristics to other Navy fighters. Although these vertical entries also provided very wild tail slides of up to 5,000 feet loss of altitude before the spin started, the Tiger came through these tests like a throughbred with very tame spins and recoveries. Altogether, I performed 154 spins and recoveries to complete this demonstration.

Because I had encountered a very wild spin and had to do over twice the number of spins originally planned, I decided to talk to Bob Hall, who was my boss, and try to increase my extra-hazard bonus that we had agreed to before the flights had been performed. I presented him my smoothly prepared speech. He smiled and asked me to repeat my thoughts as to why I should get a bigger bonus. I could see that I was not really making much headway when he interrupted me and said that he didn't think that I had been under any more extra-hazard because I was standing in front of him in perfectly sound health. Upon hearing this, I put my tail between my legs and disappeared as fast as I could. When I became director of flight test, I had the unique pleasure of using his words twice to other seemingly underbonused test pilots..!

TRANSONIC CROSS COUPLING: A NEW PHENOMENON FOR GRUMMAN

During my stay at Edwards AFB for the flame-out landing tests in early 1955, I started hearing from the USAF test pilots who flew chase with my test flights about cross coupling at transonic Mach numbers, especially at the higher altitudes. They described cross coupling as some very wild maneuvers that occurred if fighters were rolled over 360° at full lateral stick deflections above .9 Mach number. They weren't very clear, but they did refer me to Walt Williams who was the director of the NACA High Speed Flight Facility at Edwards. I had made friends with Walt and many of his test pilots when I had flown the XF10F-1 Jaguar at Edwards in 1952, so I hoped that such information would be available to me.

The importance of rapid, smooth rolling capabilities is well understood by the combat pilot. High rolling power in a modern fighter makes it the sure-fire winner in both attack and evasive maneauvers. None of the jet fighters prior to the Century Series airplanes had any rolling limits beyond the fighter pilot's adrenalin-powered arm strength.

Walt Williams said that the cross coupling phenomena encountered by the supersonic USAF Century Series fighters occurred because the designs of this new breed of airplanes had changed the three axis inertia ratios considerably from the older subsonic F-86 and F-84 designs. Basically, the longitudinal and directional inertias were much higher, and the lateral or rolling inertias were much less. He also said that the inertia axes did not necessarily stay as close to the aerdynamic or geometric axes of the airplanes as they had formerly done. He amplified by adding that this was because engines now required afterburners which made them considerably longer than the non-afterburning engines. Their fuselages were thus necessarily longer and thinner than the subsonic fighters. This caused the location of the fuel, weapons systems, and cockpit weights to be much further from the center of gravity than in the subsonic designs. He also said that their wings were much shorter in relation to the fuselages, further aggravating the problem.

He was most generous in showing me the theoretical calculations of various aircraft of both the subsonic and supersonic designs that were now flying and comparisons of them with actual flight test data. In summary, it was very clear that fighter pilots could not use continuous full lateral stick deflection rolling in combat as they could do in the subsonic fighters. Both NACA and several contractors had already demonstrated that their Century Series fighters would be limited to one 360° roll above .9 Mach number. Some were limited to 180° of full stick roll. All of the fighters were restricted to lateral stick deflections applied at a slow rate especially when supersonic. It had been demonstrated in flight that rolling in excess of these figures would bring out some very interesting and dangerous products of cross coupling. These features were induced by certain combinations of yawing, pitching, and rolling greatly in excess of the airplane' normal manuevering capabilities. Most of the Century Series fighters pitched up, but the Lockheed F-104 pitched negatively when cross coupling was encountered. Because

of the intricate and doubtful calculations, he further stated that test pilots had to enter this area of flight to see just what would happen to their specific design.

When the roll limits were exceeded, the airplanes could increase their rolling velocities to several times the normal rate combined with severe pitching Gs, sometimes well over the design limit of the airplane. This was an area to be approached most carefully. Walt also pointed out that the only recovery known was for the pilot to release all stick and rudder pedal forces and let the controls return to neutral. He said that the airplanes were gyrating so fast that it was impossible to use the controls with the right timing, possibly causing ever wilder excursions. He did impress me that we should proceed very slowly in our flight test program. In looking over our new enlarged fin design he agreed that this would help delay the onset of cross coupling greatly, compared with the smaller fin with which we had started our flight testing program. He was kind enough to provide several NACA reports so our engineers could be brought up-to-date with their efforts.

As I had performed several high speed continuous 720° rolls in air shows with no trouble, we decided to start our flight test program at 25,000 feet from a fairly low speed and increase our speed by 25mph at a time. Our tests showed that 720° rolls coulds be safey performed to about .9 Mach. At .925 Mach we met cross coupling instantly after 360° of roll had been accomplished. After about 420° of full stick roll, the nose of the airplane pulled up to about 5G without any efforts on my part, and the rate of roll at the same stick deflection increased instantly from 180 to 400° per second. The increased G was still increasing as I released the stick and rudder pedals. I don't know how high it might have gone, nor did I want to know. It was like the airplane had changed from a smooth roll to a high g snap-roll without any imput from me. I immediately released the controls and the airplane recovered very rapidly to one G level flight. We never did any testing beyond the first onset of cross coupling because it was clear that these excursions were well beyond a pilot's ability to ascertain correct recovery control deflections. I had been forewarned, but it was still a real eye opener. I landed immediately. We inspected the airplane and the recorders. To our relief, we found that no structural load limits had been exceeded. We probed the limits in a similar fashion at all altitudes and found that the Tiger was limited to 1.1 Mach for 360° full stick rolls at all altitudes. Up to 1.3 Mach full stick roll was limited to 180° of bank angle change. Above 1.3 Mach bank angle change was limited to 90 degrees. Needless to say, I became most proficient at releasing the controls when the Tiger met its cross coupling foe. This was duly noted in the Pilot's Handbook.

The Tiger exhibited the by far greatest roll envelope, before cross coupling occurred, of all the supersonic fighters of that time period. Our Pilot Handbook warning also must have been heeded because the Grumman Service Department never reported a problem with this restriction in squadron operational flying. We hoped that nobody held the controls after cross coupling started because we knew that the Tiger could exceed its design structural limits. If they had met cross coupling once, I'm sure that they would have been too scared to report it or try it again.

Below, one of the prototype Tigers conducting armament tests with four Sidewinders mounted on the wings. The aircraft is overall white with da-glo red nose, wing & fin tips. (Grumman)

THE GRUMMAN F11F-1 SHOOTS ITSELF DOWN BY TOM ATTRIDGE

Above, Tom Attridge in BuNo. 138620, the "Tiger that shot itself down". The black powder stains along the length of the lower fuselage identify the airplane's use as the gun test vehicle. The wing mounted fuel tanks were test area rule units designed by Grumman. The aesthicilly handsome tanks showed very little drag reduction over the standard Navy tanks and would have been a problem of storage on every carrier in the Navy. (Grumman)

One of the more famous jet aircraft testing events of all time was when the F11F-1 shot itself down. This story made headline news everywhere by virtue of the almost near impossibility of its happening. In order to get the full and complete story, I asked Tom Attridge, the Grumman experimental test pilot who flew this strange flight, to write it in his own words and from his own log book. I quote from his letter of 30 July 1996, which was almost forty years after it happened.

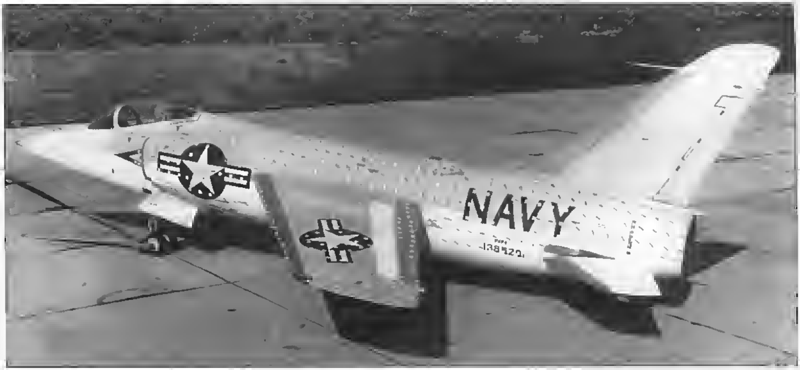
"My recollection of the 21st day of September, 1956, is that I was scheduled to fire the guns of the first F9F-8T (the two-place trainer version of the F9F-8 swept-wing fighter) for the first time. Remembering how you, Corky Meyer, blew the nose off of a F9F-2 Panther during gun firing, I went to ask Fred Rowley (Director of Flight Test) if this shouldn't be an extra-pay bonus flight. His answer was a big NO!! So I fired the F9F-8T test uneventfully. Later in the day I flew F11F-1 138620 (17th production aircraft) in which I had fired the guns in level flight on six different occasions, all at 40,000 to 50,000 feet of altitude and with afterburner blowout every time the guns were fired. The afterburner was easily relit after the firing ceased.

The next series of F11F-1 armament demonstrations was to be gun firing at speeds in excess of Mach 1 below 20,000 feet. As you know, to maintain speed at that altitude, I had to be diving at slightly less than one G, so that I was pushing over at about .8 to .9 G. Everything went well, and after about 15 minutes I was back on the ground to be rearmed for another flight.

While we were refueling and reloading the four 20mm cannons, we saw a few scratches on both sides of the vertical fin, which we couldn't explain, but we didn't think they were critical so off I went to do it again. They proved to be very critical!

On the next flight I fired the full load of ammunition and I felt a thud on the airplane as if I had run into something. The engine immediately became quite rough, necessitating me to reduce the engine power to 70% where it smoothed out. I proceeded then to fly directly from the gunnery range 20 miles out over the Atlantic Ocean back to Grumman Calverton airport as fast as I could at very reduced power. I then informed the Grumman airport tower that I had hit something and was returning to base. The ten minute flight was uneventful but nerve wracking because I didn't know just what caused my engine to roughen enough to need to be throttled back so much.

When I reached the airport and entered the final approach, the engine was still running well. Everything was under control, gear down at about 150 knots airspeed on final approach, until I put my flaps down. As you will recall, there is a longitudinal feel system cam that shifted the stick force and the elevator when the flaps were extended. As the stick force and elevator travel changed, there was a momentary bobble in the airplane's flight path, causing the airplane to go below one G for a short time. This was all it took to dislodge the bullet, which we later surmised had previously been lodged precariously in the leading edge of the engine air duct. Well, you know just what happens when a heavy foreign object hits the whirling engine turbine rotor. It sounded like a Hoover vacuum cleaner picking up gravel from a rug. The engine rpm started down rapidly of its own accord so I cut



the power completely and made a straight approach to the trees about 1/2 mile from the end of the runway. The picture shows the rest of the story.

When the airplane came to rest, I climbed out of the airplane but found that I was still attached to it by the lanyard of my PK-2 life raft. I had Walter Berndt's Swedish survival knife in my Mae West so I cut myself free. Then I looked for a place to sit down. At first I sat fairly close to the airplane so I could be located from the air more easily, but as the fire continued to burn some residual bullets began to explode. I moved further away from the wreck, although knowing that it would make it much harder for our helicopter rescue team to spot me through the dense trees. They did find me and Ed Cartowski, our great helo pilot, lifted me up through the trees and whisked me to the Riverhead hospital about ten miles away.

The doctors in the Riverhead hospital propped me up in bed, not knowing that I had a broken back. My brother-in-law was an intern at Bellevue hospital at the time, and my wife got him to take a look at me. He made arrangements for me to be transferred to Manhasset hospital, which would be close to my home. The minute they put me on a stretcher my back pains ceased, and I was put under the care of a doctor who had Air Force experience. As a result of his expertise, I recovered rapidly and I was flying again in less than six months.

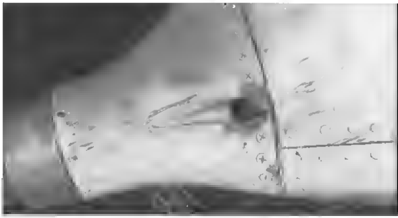
After the flight, the inspectors determined that I had run into four of my bullets. The bullets were located as follows. One was at the base of the windshield bullet-proof glass; the second went directly into the engine duct and hit the engine squarely on the front rotor stage of the compressor, causing the immediate roughness after the firing; the third one hit the leading edge of the engine air duct and temporarily imbedded itself; and the fourth one hit the nose cone of the airplane near the in-flight refueling probe. The reason for the bullets hitting the airplane was that I had to keep the airplane in a curved flight path downward to maintain my speed and I caught up with these four as they slowed down. After the crash, the scratches were inspected microscopically and it was determined that they were from the rifling on the bullets themselves and not the cases and links, which was what the inspectors had previously surmised. On the previous flight, I must have had more negative G during the dive as some of the spent bullets went over the cockpit and scratched the fin.

The seat in my airplane was smashed considerably so Grumman tested another seat to that same amount of destruction and found that it required 68 Gs." End of quote.

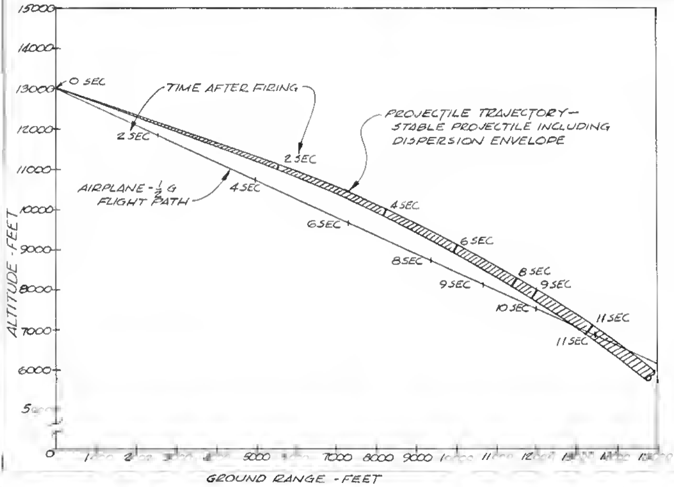
Above, 138620 prior to the shoot down with tufting attached. The white area ahead of the landing flaps are the flaperons which were used on the Tiger instead of ailerons for lateral control. This allowed for full span flaps to be installed. (Grumman via C. Meyer)

Shortly after that at Edwards, an Air Force F-100 was shooting its 20mm guns under the same negative G supersonic circumstances and was shot down by its own bullets when it caught up with them. When I heard about that happenstance, I delivered a copy of the report of Grumman's experience and the Air Force adopted the Navy restriction that supersonic gun firing should be done under positive G only.

After more than 125,000 rounds had been fired in ground tests and over 145,000 rounds were air-fired by Tom Attridge without another major incident, the required test program was completed and accepted by the Navy. During these tests, guns were fired from sea level to over 50,000 feet, up to 1.3 mach, and to 750 mph indicated air speed. The Tiger had become a fanged day fighter.



Above left, entry hole of 20mm shell in the nose cone of 138620. Above, windscreen strike position of bullet. (Grumman)



FASTER THAN A SPEEDING BULLET! The diagram shows just how the Tiger shot itself down. I f you look at the time scales of the aircraft and the bullets it is easy to see what nobody thought about before this event happened. In subsonic gun firing the bullets had a greater speed differential to the airplane. Supersonically, the bullets had high supersonic drag to slow them down and the airplane had afterburner power to keep its speed up and catch up with them. (via C. Meyer)

At left, bullet as found in the engine after the crash. Below, the bullet after its removal from the engine. (MFR via Meyer)

Above, the final resting place for Tom Attridge's Tiger, which was only about 1/4 of a mile from the end of the runway at Calverton. You can see the path of trees that he cut down. it is easy to see that the helo pilot might have had a job finding Tom in this jungle. (MFR via Meyer)

Below, the trees were over 12 inches in diameter and they took off the wing and tail from both sides of the fuselage. It was a wonder that the airplane stayed upright until it came to a stop. (MFR via Meyer)

J65 ENGINE FAILURE & CRASH AT BY ERNIE VON DER HEYDEN

Because of Grumman's lack of faith in Curtiss Wright's engines in general and afterburners in particular, and with winter coming to our test areas far out over the Atlantic Ocean, Grumman decided to move two Tigers (BuNo 138608 and 138609) to Edwards AFB to continue performance and gunnery tests in the good weather of the Mojave Desert. Ernie Von der Heyden was the engineering test pilot selected to do the tests in October 1955. I will quote from his 8 January 1997 letter to the author.

"Testing started at Edwards with new-production J65-W-18 afterburning engines in both aircraft. Performance measured was typical speed/power polars for the full speed range and at seven altitudes from 1,000 to 50,000 feet in 138609. This aircraft had a swinging-probe pressure rake to determine the pressure distribution of the engine and the surrounding slipstream to about 12 inches beyond the fuselage contours.

This was the most accurate method to determine thrust performance. We knew that we needed to extract every pound of thrust that the engine could put out. Some of the performance work involved close adjustments of the fuel control using cockpit gages and a pilot-operated vernier knob for very close adjustment. That really challenged my ability to read, adjust, and fly at the same time. Fortunately, planes were not so numerous in the California skies at that time so we had no mid-airs. We had numerous engine development problems to solve, but by the beginning of 1956 we were finally getting a handle on the finality of the vastly inadequate performance of the Tiger that the Navy and Grumman were going to have to live with.

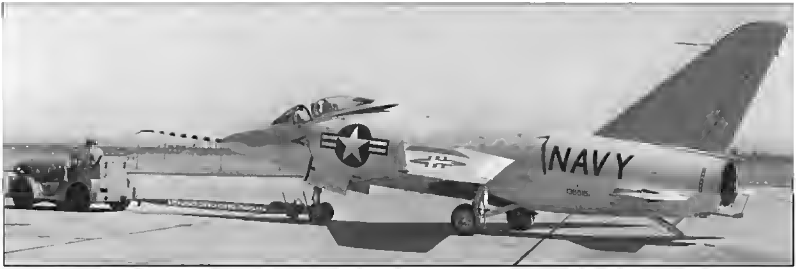
As there was apparently nothing but coyotes and expendable uranium miners in that area, I was also flying gunnery tests in BuNo 138608 over the "Mojave" test area north of Edwards. These firings, at many altitudes and at both sub and supersonic airspeeds, and with various link diffuser schemes, were attempts to eliminate link jams and pile ups inside the gun bay as well as checking continuous firing rates, gun gas concentrations and gun cooling.

My old flight log books show that we ferried BuNo 138611 out to Edwards in March 1956 and we started gun firing tests on it as of the 7th of March.

Patuxent Service Test pilots Major Earl Gray and Lt. Neil Heffernan USMC came to Edwards with a Tiger to determine engine-out landing patterns using the vast lake bed areas for landing safety. To help them out we furnished one of our Tigers to be flown by a Grumman safety pilot during chase. The chase aircraft was used to develop the simulated engine-out aircraft configuration by using a combination of idle engine power and the drag of a partially extended speed brake to maintain close formation with the Navy's Tiger performing the actual engine-out landing pattern.

On 3 April 1956 Major Gray and Lt. Heffernan were to make such a formation flight but Major Gray had

Below, 138609 as well as 138608 were the performance test aircraft at Edwards in early 1956 and were fitted with the same double windscreen as used on the Super Tigers, but they did not have the power to utilize the drag decrease the windscreen provided and it was never put into production on the Tiger. (Grumman via C. Meyer)



Above, the last pre-production F11F-1, BuNo 138618, was brought to Edwards by Patuxent Test pilots Maj. Earl Gray and Lt. Neil Heffernan. The aircraft was used to determine engine out landing patterns using the vast lake bed areas for landing safety. (Swisher 5-18-56)

other duties so I volunteered to be the simulation chase pilot. While I was flying close formation in 138608 with Lt. Heffernan, all of the red emergency lights in the cockpit came on, the engine shut down, and I found that I had no lateral control to stop an uncommanded rolling motion of the airplane. All of the above happened in a split second. I pulled the handle several times rapidly to deploy the emergency hydraulic power to the controls immediately. It didn't. And as I had no other option, I said "Sayonara", and ejected. This took absolutely no decision on my part as I had absolutely no engine power and no control of the aircraft. The ejection went as expected, but as I tumbled I noticed that the parachute was deploying between my legs and that one chute riser line wrapped itself over the middle of the open chute canopy making a "brazier" chute. Because the chute was not fully opened I tried to pull the offending riser of the center of the chute. It looked like I might collapse one of the halves that was open so I stopped playing with the chute. Because of the half-opened chute, I also noted unhappily that I was coming down very fast and was almost on the lakebed. I hit hard on my heels, collapsed my knees and then sat down

Below, BuNo 138611 was ferried out to Edwards in March 1956 for gun firing tests and to supplement the engine testing program. The four black objects surrounding the aft end of the fuselage were one of many attempts to increase the supersonic speed of the Tiger, none of which worked. The revised gap in the front speed brake installed here greatly reduced blockage of air to the emergency hydraulic Ram Air Turbine (RAT). The black lines just behind the front speed brake delineate the position of the retracted Ram Air Turbine. (Grumman via Meyer)

hard on my backside crushing several vertebrae in the process.

Although the rescue helicopter arrived shortly afterwards, I had great misgivings about riding in any kind of aircraft so soon after my past unexpected excursion from one.

The crash wreckage was thoroughly inspected. It revealed that the single engine-driven "tower shaft" from the power section of the engine to the engine accessory gear box, driving both fuel pumps, both hydraulic pumps, the electric generator, and the vacuum pump, had sheared causing the engine flame out and the loss of hydraulic control power. The reason I had no re-establishment of hydraulic power to regain my flight controls, when I pulled the handle to deploy the Ram Air Turbine, was that the release mechanism failed and it didn't deploy. We were not yet finished with failures of J65 engines in our gunnery flight test program. But such is a day in the life of an experimental test pilot."

F11F-1 PERFORMANCE DEVELOPMENT TESTING

After the first abortive test of the J65 prototype afterburner at Edwards in F11F-1 BUNo 138605 on 25 January 1955, Grumman did not receive another from Curtiss-Wright until the end of April 1956, some fifteen months later! This seemed ridiculous since Pratt & Whitney had been producing excellent working afterburners for the F-100 and other Century Series fighters since early 1954. The fact that this was the first afterburner designed, developed, and tested by Curtiss Wright, and that the Tiger was the only airplane scheduled for that afterburner, were two very powerful reasons why the J65 delayed the Tiger's schedule two years. The crash of the first prototype certainly didn't help the program either.

When we finally received the prototype J65-W-14 with afterburner, it was still deficient by 500 pounds of thrust. We installed it in BuNo 138609, ferried it to Edwards in a USAF C-124, and flew 12 flights between May 7 and 21, 1956. The engine performed well but the 500 pounds missing thrust produced only 1.05 Mach level flight speed at 35,000 feet. We were hoping to make the contract speed of 1.2 Mach.

Production J65-W-18 afterburning engines began to be delivered in March 1956. By October, all production J65 engines, including the -18, had accumulated over 1600 flight test hours of which 945 hours were at full non-afterburner thrust and 69 hours at full afterburner. Engines were being delivered at last with 10,500 pounds of thrust. This was still 500 pounds less than Curtiss Wright's original contract.

BuNo 138609 was returned to New York on 25 May 1956, and an aircraft performance improvement program was started in earnest. The following changes were tested:

1.) The aft 3 feet of the fuselage was refaired so that it did not converge as rapidly as the prototype, which required a blunt fuselage trailing edge. This reduced the base drag of the aft fuselage at the tail pipe exit. Many shapes were tested until an optimum shape was selected which was satisfactory for the entire flight envelope.

2.) NACA had done some wind tunnel tests with bumps on the aft fuselage to simulate better area rule pressure distribution. We tried many shapes and sizes in flight. Not only were they ugly, but they contributed no performance increase. In fact several of them decreased the speed.

3.) A triangular fairing was added at the wing root leading edge/fuselage intersection. This had a questionable effect on the F11F-1, but it gave surprising performance increase on the Super Tiger with the J-79 engine. It also made the airplane look faster.

4.) Grumman designed 150-gallon external tanks with the area rule/coke bottle shape. They did not contribute anything to performance and would have put another large, non-standard item into the Navy inventory. Development was therefore dropped. Standard Navy 150-gallon drop-tanks were used operationally.

5.) Curtiss Wright finally produced the J65-W-18 in numbers with a new contract specification of 10,500 pounds of thrust. The additional thrust, combined with the revised fuselage aft end, increased the airplane's level flight performance to 1.1 Mach. It should be noted here that the original contract for the J65 engine with afterburner stated that the engine would have 11,000 pounds of thrust. The Navy and Grumman should never have let the Curtiss Wright Corporation off the hook on their specification. Grumman calculation showed that 500 pounds more thrust would have allowed us to meet the 1.21 Mach contract specification easily.

Not everyone in the industry was enamored with Dr Whitcomb's area rule/coke bottle theories. Lockheed designed their F-104 fuselage to be just slightly larger than the diameter of their J65 powered first two prototypes. These aircraft had a level flight speed of 1.55 Mach number.

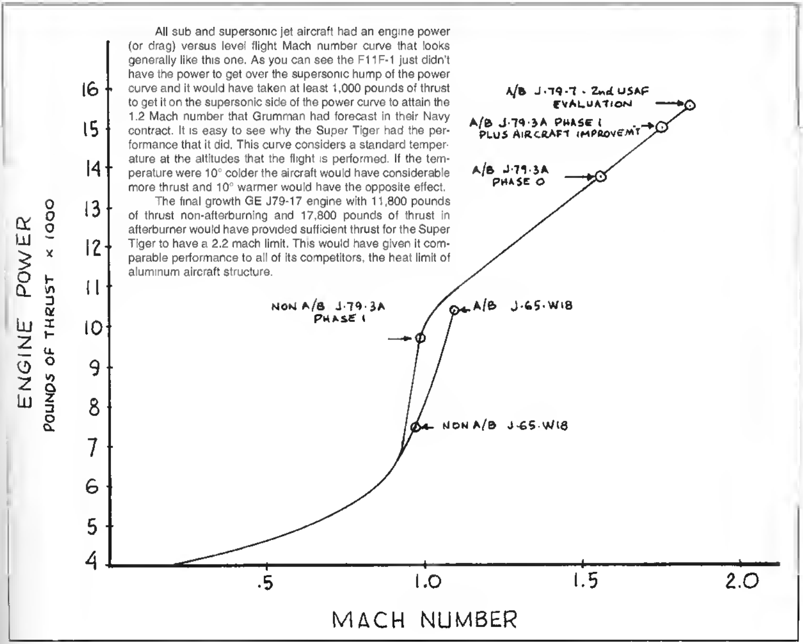
It is said that history often repeats itself. A look back 20 years seemed to be in order. In the early 1930s NACA propounded the theory that the teardrop was the perfect fuselage shape for the lowest drag for high speed airplanes. The Granville brothers who designed the fat, teardrop-shaped Gee Bee racers had fuselage maximum areas about twice the frontal area of the radial engines used. They won races until Jimmy Wendell brought out his skinny racers in which the engine determined the maximum diameter of the fuselage. He took all the speed prizes after he came onto the scene.

Remembering the Gee Bee/Wendell design philosophy, I carefully measured the maximum diameters of the F-104 and the Tiger designs. I found that the Tiger area rule requirements added about 2.5 square feet of fuselage frontal area over the F-104. This was a big drag

Above, engine testing and the short-nosed Tiger continued to operate out of Edwards into the 60s. BuNo 138615 is seen on 5-22-60 with da-glo red nose, tail and wing-tips. Note the large Tiger characature on the tail. (William Swisher)

All sub and supersonic jet aircraft had an engine power (or drag) versus level flight Mach number curve that looks generally like this one. As you can see the F11F-1 just didn't have the power to get over the supersonic hump of the power curve and it would have taken at least 1,000 pounds of thrust to get it on the supersonic side of the power curve to attain the 1.2 Mach number that Grumman had forecast in their Navy contract. It is easy to see why the Super Tiger had the performance that it did. This curve considers a standard temperature at the altitudes that the flight is performed. If the temperature were 10° colder the aircraft would have considerable more thrust and 10° warmer would have the opposite effect.

The final growth GE J79-17 engine with 11,800 pounds of thrust non-afterburning and 17,800 pounds of thrust in afterburner would have provided sufficient thrust for the Super Tiger to have a 2.2 mach limit. This would have given it comparable performance to all of its competitors, the heat limit of aluminum aircraft structure.



penalty for the Tiger, especially in transonic and supersonic speeds. The Century Series fighters overcame a lot of their drag by more thrust in their afterburners. Grumman found that was the solution when the Super Tiger was flown. I have wondered many times just what performance the Tiger and Super Tiger might have had without frontal area drag penalty of the Whitcomb Area Rule.

COMPLETION OF THE F11F-1 DEVELOPMENT PROGRAMS

Because of the crash of the first Tiger, flight test did not receive another instrumented airplane until the 6th production article (BuNo 130610) on 6 August 1955. I finished the Part I non-afterburner structural demonstration in that airplane on 21 October 1955. It would have been done a month earlier if the Ram Air Hydraulic Turbine had not ripped off the airplane on the scheduled last flight of that demonstration. The part II structural demonstration was transferred to Ralph Donnell. When the first production J65-W-14 afterburner was delivered and tested, it was transferred to this airplane from BuNo 138609. The final speed altitude envelope for the F11F-1 Tiger was as follows:

The maximum dive Mach numbers attained during this phase of testing were Mach 1.553 or 747 mph at 22,990 feet and Mach 1.41 or 926 mph at 8,090 feet.

The maximum Gs attained were:

50,000ft.	Mach 1.07	3.0G
40,000ft.	Mach 1.36	5.4G
30,000ft.	Mach 1.52	6.2G
20,000ft.	Mach 1.55	8.0G
10,000ft.	Mach1.47	7.5G

447 subsonic and supersonic rolling maneuvers completed that portion of the structural demonstration with the maximum G of 5.18 attained.

Maximum rudder pedal deflections were performed at Mach 1.55 or 747 mph at 22,000 feet.

TIGER MAINTENANCE MAN HOUR PER FLIGHT HOUR RECORD

Although the F11F-1 did not have a maintenance specification requirement, both Grumman and the Navy records show that it could be operated at between 4 to 6 maintenance man hours per flight hour. That was about one third the figure of the next lowest fighter competitor. It was surely one of the basic reasons that the Blue Angels kept flying it until 1969, long after it had ceased operational flying in 1961.

F11F-1, THE FIRST NAVY COMBAT AIRFRAME TO HAVE FATIGUE TESTING

In the early 1950s, when transonic and supersonic aircraft began to appear, it became necessary to develop airframe construction methods completely different from those previously used.This was necessitated by the increase of normal flight speeds by several hundred miles per hour which increased gust loads by an order of magnitude. The very thin wings and tail surfaces required by higher speed flight were now being milled out of aluminum planks instead of being constructed from hundreds of sheet metal detailed parts. Fuselages also had to have newer construction methods to meet the tighter internal packaging of engines and systems to create the lowest frontal area drag.

In the subsonic era the Navy required no more than the time-tested static load tests to demonstrate that the airplane was strong enough for its anticipated service life. One of Grumman's most far-sighted decisions, commencing with the Tiger test program, was institution of the 6,000 hour fatigue tests, cycling the entire airframe and its many components thousands of times. The success of this program was demonstrated by the 16 year tenure of the Tiger with the Navy Blue Angel Flight Demonstration Team. All Navy aircraft were required to undergo such fatigue testing after 1955.

Below, the 5th production Tiger shows its clean lines and the unique nose cone refueling probe used on the short nosed Tigers. (Grumman)

Above, the first production Tiger, BuNo 138617, being tlown by production test pilot Vince Fastennella on its tirst tlight. When the refueling gear was installed in the nose ot the aircraft, the airspeed pitot tube was located on the tin ot the aircratt. This airspeed system was affected somewhat by the transonic shock wave generated by the airplane, but was the best location we could find trom eleven locations tested. (Grumman via C. Meyer)

Below, brand new early production short nosed Tiger at the Naval Air Test Center, NAS Patuxent River, Md., on 14 November 1955. The landing gear was painted silver and the edges ot the gear doors were red. (National Archives)

CARRIER SUITABILITY TESTS

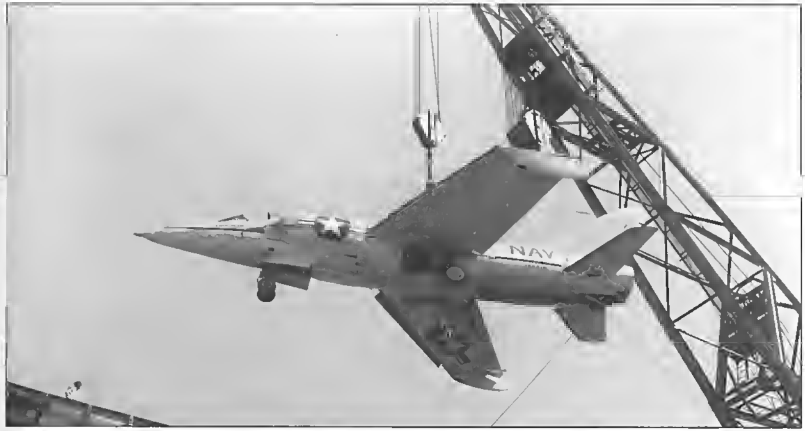
At right, John Norris makes a 20 foot off-center arrestment of BuNo 138614 at Patuxent River, Md., in January 1957. This was the maximum off-center arrested landing requirement. After the tail hook caught the wire it yanked the airplane to the right 30° from its original landing path, almost causing the right wing to hit the ground. To compound structural requirements further this landing was also a maximum limit sink speed of 17 feet per second as it caught the wire. The USAF had no off-center requirement and required only a maximum sink speed of 10 feet per second. (via John Norris)

In preparations for carrier testing, the landplane demonstration consisted of 84 arrested landings up to a vertical sink speed of 17.4 feet per second. An 8 foot per second landing is rough. Above 10 feet per second the airplane is inspected between each landing. A 17.4 feet per second landing is a controlled crash.

Carrier suitability tests were conducted aboard the USS Forrestal (CVA-59) in April 1956. The tests were deemed successful and the Tiger was cleared for BIS and FIP trials prior to induction into fleet service. During the tests, sixty-six carrier arrested landings covering all on center and off center arrestments per specified test conditions were competed without incident. Fifty-six launches on the H-8 hydraulic and C-7 steam catapults were made to an acceleration of 5.4 longitudinal G with catapult end speeds up to 172 mph on the steam catapult.

Above, minimum landing speed field carrier landing trials at NATC Patuxent. The test pilot has just been given the cut instruction as seen by the landing signal officer moving his right arm flag to his left side. (Grumman via C. Meyer)

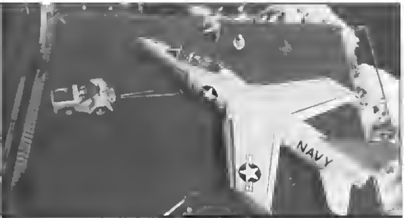
Below, the second production airframe BuNo 138618 launches from the USS Forrestal in April 1956. Note position of opened canopy and forward drooped wing slats. (Grumman via Meyer)



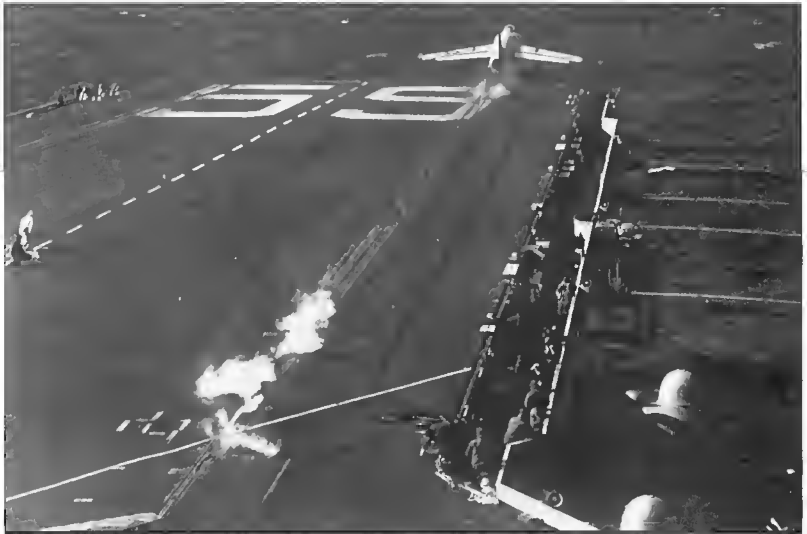
Above, #2 production Tiger BuNo 138618 being hoisted aboard the USS Forrestal (CVA-59) for carrier trials in April 1956. This aircraft differed from the #4 prototype BuNo 138607 primarily in having the enlarged vertical fin and the nose cone refueling probe installed. (National Archives)

Below, the #4 Tiger prototype BuNo 138607 being towed to the Forrestal's catapult on 4 April 1956. This airplane has the small vertical tail. The wing folds seem almost unnecessary, but were needed to fit all carrier elevators of the day. The fuselage stripe was black. (MFR via C. Meyer)


NAVY



At left top, the fourth prototype BuNo 138607 being hooked up for carrier launch from the USS Forrestal during April 1956. The name LT. JOHN MOORE is painted under the canopy rail. (National Archives) At left bottom, BuNo 138618 on the Forrestal's forward catapult during April 1956. The names under the canopy rail were LT. J.G. LORD and J. D. KINGCADE AD2. Both aircraft were gull grey & white with a black fuselage stripe. The area under the wing slats were red and the leading edges including the slats were natural metal. (National Archives) Above, 138607 & 138618 being spotted on the deck of the Forrestal during carrier suitability trials. (National Archives) Other photos, 138618 being moved about on the Forrestal's elevator. (National Archives) At right, 138618 is moved onto the elevator after an arrested landing. Once extended, the tailhook could not be retracted from the cockpit, it could only be retracted by the ground crew. (National Archives)



NAVY BIS AND FIP TRIALS - THE FINAL DEVELOPMENT

The Bureau of Inspection and Survey trials leading to Fleet Indoctrination Program were scheduled to start in the spring of 1956, leading to squadron use later that summer. Carrier operations in April were successful, but a pre-BIS look at the airplane showed that the fuel consumption was greater than planned. Therefore, the carrier cycle time (from launch to recovery) for a fighter mission was unacceptably short. Service introduction had to be postponed, and Grumman had to retrofit the Tiger with additional tanks they had designed previously but had not installed. These were the fin and fuselage cheek tanks. Installing fuel tanks both in the fin and over the engine air ducts ahead of the wings kept the airplane in its proper balance. These increased internal fuel from 914 to 1,092 gallons. The cycle time was increased to 1.64 hours without the two 150 gallon external tanks and to 2.20 hours with the tanks installed, thus satisfying the cycle time requirements.

At left, launch sequence of 138618 during carrier trials aboard CVA-59 in April 1956. The Tiger's end speed on the steam catapult was 140 knots. (C. Meyer & National Archives)

At right, BuNo 138614 was used during BIS and FIP trials. It was used primarily to test all stores during critical carrier operations. It is seen here "in the groove" over the Saratoga with four Sidewinders mounted on the wings. (MFR via C. Meyer) Below, 138614 is given the launch signal aboard Saratoga while VX-3 Tiger 138617 waits its turn next to the island. (via S. Nicolaou)

Two views of 138614 aboard the USS Saratoga (CVA-60) while fitted with Grumman area rule wing tanks and inert AIM-9 Sidewinders. Aircraft was gull grey & white with da-glo red nose, fin tips and vertical tail. The fuselage stripe was black. Above, 138614 is seen with VX-3 short-nosed Tigers 138639 (#56) & 138637 (#54) in 1957. (Grumman via S. Nicolaou) Below, 138614 taxiing into the launch position. (Grumman via C. Meyer)

Above, first BIS trials aboard the Forrestal on 23 March 1956 with CDR. R. R. Flynn flying the tests. The pilot in the F9F-8T Cougar trainer is CDR. Allan Shepard, who was to become the United States' first Astronaut. (Grumman via C. Meyer) Below, two short-nosed Tigers from VX-3 during operational tests aboard the Saratoga. Tiger 138627 is being towed from the island to the catapult. Note extended pilot's access steps and folded wing tips. (Grumman via S. Nicolaou)

FINAL DEVELOPMENTS & TESTING FOR FLEET SERVICE

Although the Tiger was designed to be a day fighter, Grumman knew from past experience that it would be required to assume the attack role in its future. The Tiger therefore had four external stores racks designed into the wing structure in the first prototype. The outboard rack could carry 1,000 pounds and the inboard rack could carry 3,500 pounds. Ralph Donnell, Tom Attridge, and John Norris completed the external stores demonstrations in early 1957. Carrier stores testing had not been finished at this time and was continued through September. During that time the Grumman 150 gallon area rule tanks were found to have more drag than predicted and testing was discontinued. During this time the nose of the Tiger was redesigned to incorporate the AN/APG-30 gun ranging radar. This required changing the in-flight refueling probe from the center of the nose to the front upper right portion of the nose cone in front of the pilot. In addition to the new nose and the retractable refueling probe, a distinctive forward swept-wing extension was added to the wing at the front wing root. All of the aircraft in the second contract had these changes incorporated. However, the radar was never operationally installed as the system met with continuous delays. Because of these changes, weapons testing was continued on the long nosed Tigers.

The short-nosed Tigers were initially assigned to Air Development Squadron Three (VX-3) at NAS Atlantic City, New Jersey, in February 1957. The short-nosed Tigers entered fleet service with Attack Squadron One Five Six (VA-156) at NAS Moffitt Field, California, in March 1957. Tiger fleet delivery occurred two years later than planned, and occurred the same month that VF-32 received the first F8U-1 Crusader. A short time later VA-156 replaced its short-nosed Tigers with the long-nosed versions and all future fleet squadrons would utilize this type.

Because the Tiger's performance was soon eclipsed by that of Vought's F8U-1 Crusader, Navy procurement ended the Tiger production line and limited the number of F11Fs to 201 units, with the last fleet Tigers flying in 1961. Because of the Tiger's good handling and excellent structural characteristics, they were used to fill-in as the advanced aircraft with the Jet Transition Training Units starting in November 1958. In this capacity, they were utilized for nine years before being retired from VT-23 and VT-26 in 1967. The Tiger's longest tour-of-duty was in the hands of the Blue Angels Flight Demonstration Team from 1957 through 1969. Because of the Tiger's outstanding flight control response in rolls and high G operations, and its rugged low maintenance airframe, it was arguably the finest performing aircraft the Blues ever flew.

At left, Grumman Test Pilot Ralph Donnell on the ladder of a long-nosed Tiger for a publicity shot with intended Tiger weapons. Two Grumman area rule 150 gallon drop tanks and two AIM 9 Sidewinders were mounted on the wings. The first row in front of the aircraft shows the four 20mm guns with 500 rounds of ammunition. The second row shows 500 pound bombs, 1,000 pound bombs, and standard Navy 150 gallon drop tanks. The next row has GAU 7 and 19 2.75" rocket packs. The front row shows four AIM 9 Sidewinders with two of their launch rails. The Tiger could also carry two different type of nuclear stores that would be delivered by an over-the-shoulder LAB launch maneuver. (Grumman via C. Meyer)

Above, classic view of the long-nosed Tiger (BuNo 141736). Note the refueling probe is extended and the wing root wing addition. The aircraft was fitted with Grumman tanks and Sidewinders. (Grumman)

Below, Grumman's Calverton Plant 7 production floor after Grumman received the order for 400 F9F-8T Cougar trainers. The F9F-8T production line was put in parallel with that of the Tigers at right. The rate of combined production was 32 aircraft per month from the two lines. (Grumman via C. Meyer)

The F11F-1 airplane was a swept wing, single place, turbojet powered, carrier based, high performance day fighter. It was armed with four 20mm Mk. 12 guns and was equipped to carry four Sidewinder missiles or a mixture of Sidewinders, fuel tanks and bombs on four wing stations. Longitudinal control was achieved by an all-movable stabilizer located below the tailpipe centerline. Vented flaperons were installed for lateral control. The rudder, flaperons and all movable stabilizer were actuated by a dual hydraulic power system designed for maximum reliability. Hydraulic powered leading edge slats and large span flaps were incorporated to improve the low speed lift characteristics of the wing.

WINGS: Cantilever mid-wing monoplane. 30° leading-edge sweepback. 6.5% thickness/chord ratio. All metal structure. One-piece machined upper and lower skins. Leading-edge slats. Trailing-edge flaps over the whole fixed portion of the wings, the wingtips being manually hinged for carrier stowage. Lateral control by flaperons (spoilers), with a small trim-tab outboard of the port flap. Wing area 250 sq. ft.

FUSELAGE: All-metal structure with three finger-type speed brakes on the underside of the fuselage. One forward of the nose gear and two in line with the trailing edge of the wing.

TAIL UNIT: All surfaces swept. Tail unit was made up of a fixed fin, rudder and low-mounted all-flying tailplane with slight dihedral.

LANDING GEAR: Retractable tricycle type with all wheels retracting into the fuselage.

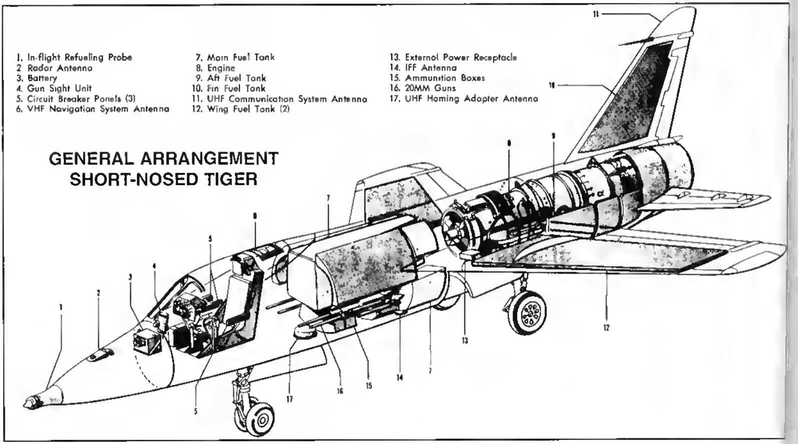
POWER PLANT: The J65-W-18 engine was of the axial flow type and incorporated 13 compressor stages and two turbine stages rotating clockwise as viewed from the rear. The engine was equipped with an afterburner and a two-position convergent nozzle. An automatic control system for positioning the nozzle in afterburner was provided. The engine was equipped with a four element fuel pump, a self-contained lubricating system and a speed density type fuel control system. The rated thrust of the engine was as follows: maximum thrust 10,500 pounds, military thrust 7,450 pounds, and normal thrust 6,470 pounds. Fuel was located in a main and aft fuselage tanks, intake cheek tanks, a fin tank and in two 150 gal. drop tanks. Max fuel 1,049 gal.

DIMENSIONS:
Span 31ft. 7.5in.
Span folded 27ft. 4in.
Height 13ft. 2.75in.
Length (short-nosed) 44ft. 1.5in.
Length (long-nosed) 46ft. 2.5in.

WEIGHTS:

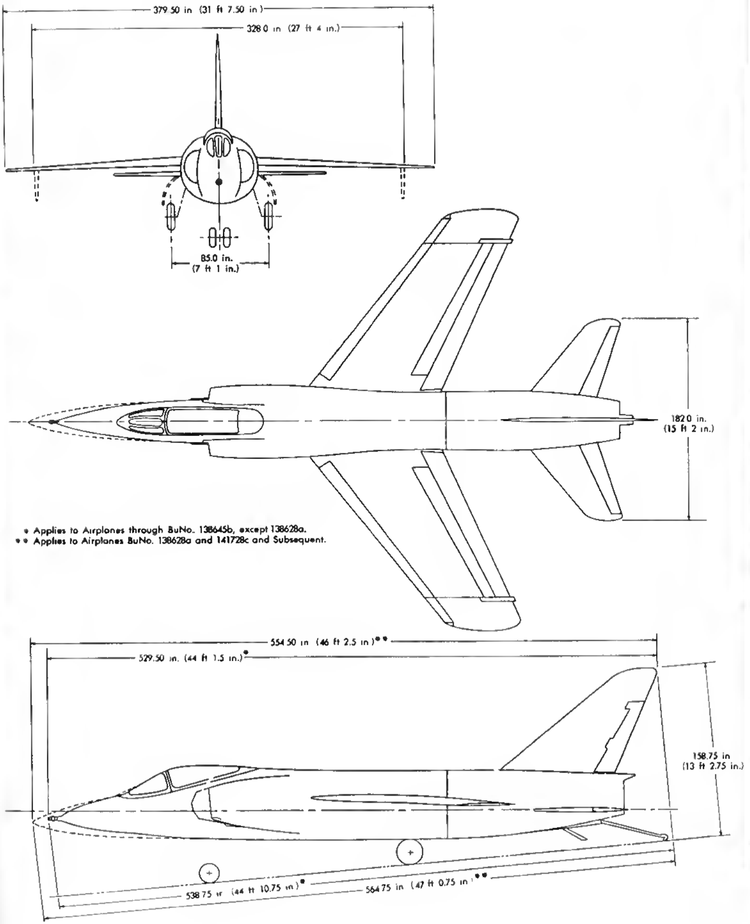
Short-nosed:
Empty 13,307 pounds
Design 18,375 pounds
Maximum 23,459 pounds
Long-nosed:
Empty 14,330 pounds
Design 21,280 pounds
Maximum 24,078 pounds

PERFORMANCE (long-nosed):
Max speed at sea level 753mph
Mach 1.2 at 35,000 ft.
Stall speed 118mph
Rate of climb 18,000 fpm.
Service ceiling 41,900 ft.
Range 1,390 miles, combat 310 miles



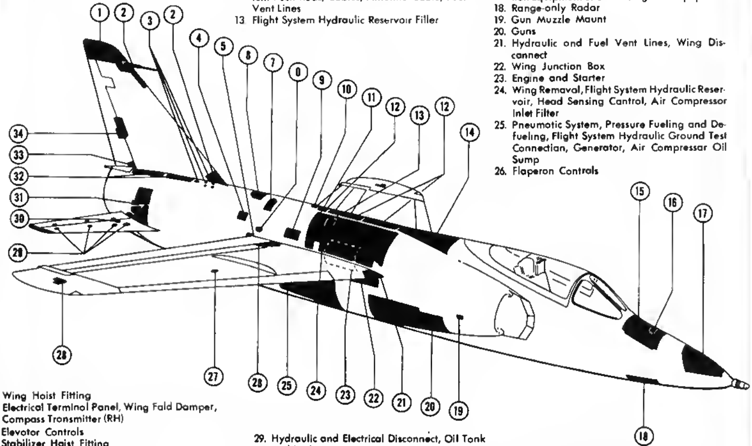
GENERAL ARRANGEMENT
SHORT-NOSED TIGER

SHORT - NOSE/LONG - NOSE AIRCRAFT DIMENSIONS COMPARISON



INSPECTION AND ACCESS PANEL PROVISIONS (SHORT - NOSE TIGER)

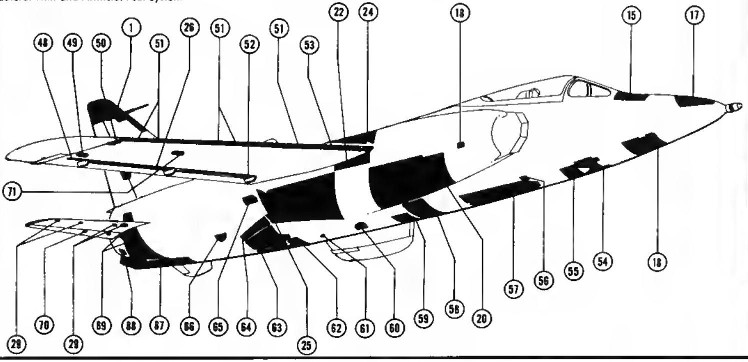
1. Antenna, Rudder Hinge
2. Pitot Lines, Antenna Cables
3. Rudder Controls
4. Control Cable Disconnect
5. Tail Disconnect
6. Controls Disconnect, Tail Disconnect, Haist Fittings
7. Hydraulic and Fuel System Lines Disconnect, Pitot and Static Lines Disconnect, Oil Strainer
8. Hydraulic Disconnect Lock Inspection
9. Hydraulic Line Disconnect, Flaperon Actuator
10. Engine Mount
11. Airplane Hoist Fitting
12. Fuel Tanks, Air Conditioning Line, Control System Push Rods, Cables, Antenno Cable, Fuel Vent Lines
13. Flight System Hydraulic Reservoir Filler
14. Control Cables, Fuel Lines, Stabilizer Push Rod, Air Conditioning Lines, Flaperan Push Rod, Compass Flux Valve
15. Forward Radio Junction Box, Battery, A-C Fuses
16. Battery Disconnect
17. Range-only Rador Equipment, VHF Navigation Equipment or UHF Novigotion Equipment
18. Range-only Radar
19. Gun Muzzle Mount
20. Guns
21. Hydraulic and Fuel Vent Lines, Wing Disconnect
22. Wing Junction Box
23. Engine and Starter
24. Wing Removal, Flight System Hydraulic Reservoir, Head Sensing Control, Air Compressor Inlet Filter
25. Pneumotic System, Pressure Fueling and Defueling, Flight System Hydraulic Ground Test Connection, Generator, Air Compressar Oil Sump
26. Flaperon Controls



27. Wing Hoist Fitting
28. Electrical Terminal Panel, Wing Fold Damper, Compass Transmitter (RH)
29. Elevator Controls
30. Stabilizer Hoist Fitting
31. Stabilizer Controls
32. Rudder Controls, Fin Removal
33. Rudder Disconnect
34. Rudder Damper
35. Gun Camera Magazine, Gun Camera Test Switch
36. Canopy Control
37. Wing Removal
38. Loteral Trim and Artificiol Feel System

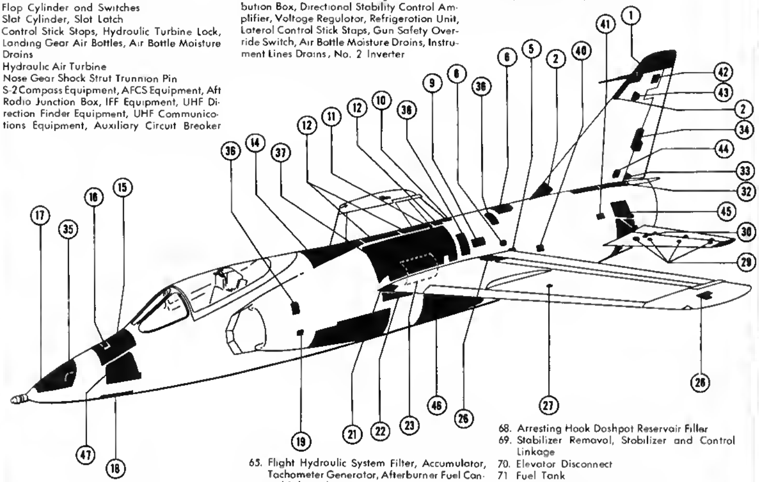
29. Hydraulic and Electrical Disconnect, Oil Tank and Igniter
40. High Level Float Switch
41. Longitudinal Trim, Elevator Locked Switch
42. Rudder Hinge, Antenna
43. Fuel Float Switch
44. Fuel Strainer
45. Stabilizer Controls, Feel Com, Elevator Position Limit Switch

46. Starting Air Control Disconnect, Pneumatic System Filler Valve and Filter, Chemical Drier, Maisture Separator, Electrical Junction Boxes, Hydraulic Pump, Oil Scavenge Screen, Priority Valve, Landing Gear Thermal Relief Valve, In- Instrument Lines Drains

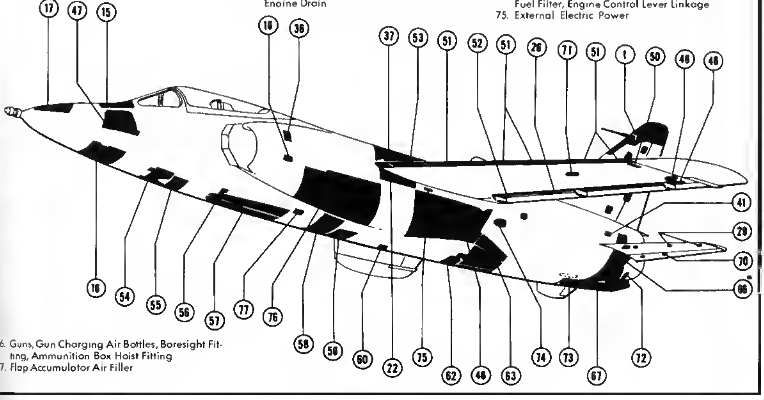


INSPECTION AND ACCESS PANEL PROVISIONS (SHORT - NOSE TIGER)

47. Range-only Rador Equipment ond Test Receptacle, Bottery Sump Jar, No. 1 Inverter
48. Wing Tonk Dump Actuotor
49. Tank Droin ond Float Switch
50. Wing Outer Ponel Releose Hondle
51. Slot Controls
52. Flop Cylinder ond Switches
53. Slot Cylinder, Slot Latch
54. Control Stick Stops, Hydroulic Turbine Lock, Londing Gear Air Bottles, Air Bottle Moisture Drains
55. Hydraulic Air Turbine
56. Nose Gear Shock Strut Trunnion Pin
57. S-2 Compass Equipment, AFCS Equipment, Aft Radio Junction Box, IFF Equipment, UHF Direction Finder Equipment, UHF Communications Equipment, Auxiliary Circuit Breaker Box, Tail Bumper Lift Switch, Gun Vent Volve, Oxygen Filler, Nose Gear Cylinder, Loterol Leveling Points, Canopy and Broke Air Bottles, Canopy Jettison and Emergency Open Valves, Rudder Pedal Stops, Gun Feeders Air Bottle, Gun Vent Doors Air Bottle, Right Moin Distribution Box, Directional Stability Control Amplifier, Voltoge Regulotor, Refrigerotion Unit, Loterol Control Stick Stops, Gun Safety Override Switch, Air Bottle Moisture Droins, Instrument Lines Droins, No. 2 Inverter
58. Ammunition Box
59. Lower Moin Tonk Access, IFF Antenna
60. Fuel Booster Pump, Fuel Tank Woter Droin
61. Wrench Hole
62. Lower Engine Access Door
63. Speed Broke Cylinder, Tail Disconnect Nut,



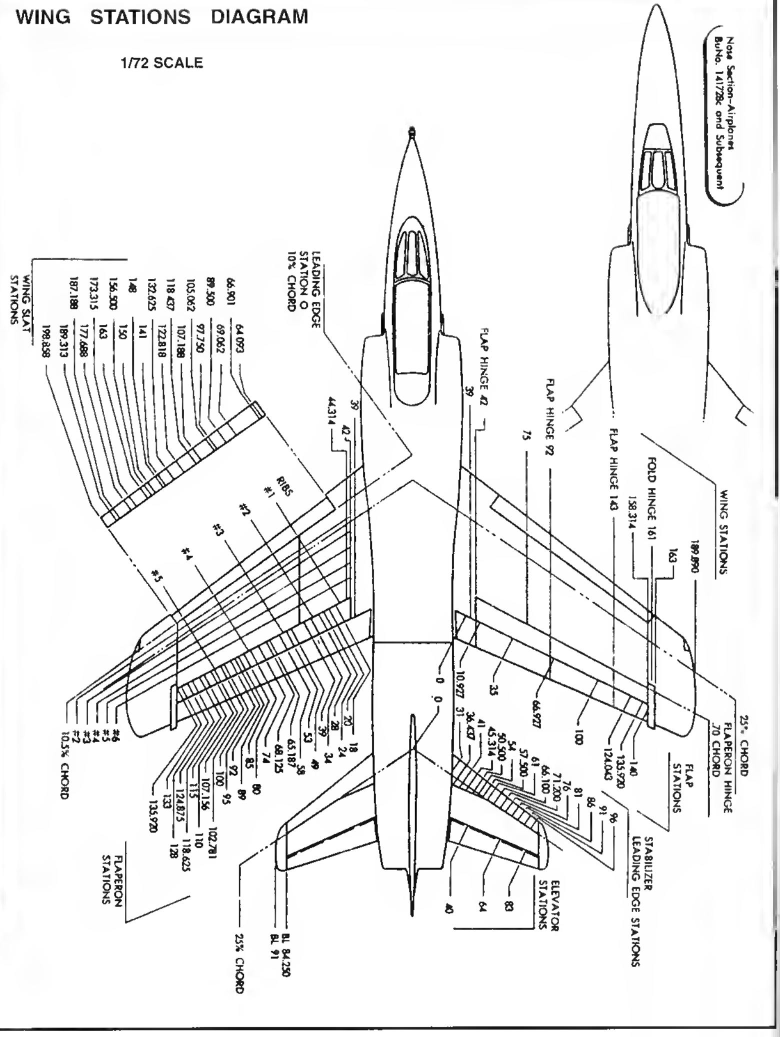
64. Flight System Accumulator Filler Valve, Speed Broke Ground Release
65. Flight Hydroulic System Filter, Accumulator, Tachometer Generator, Afterburner Fuel Control Solenoid
66. Low Level Float Switch
67. Tow Fitting, Tail Bumper Shock Strut, Hook Retraction Cylinder, Arresting Hook Downlock Release, Tie Down, Hook Stowed Switch, Engine Drain
68. Arresting Hook Doshpot Reservoir Filler
69. Stobilizer Removol, Stobilizer and Control Linkage
70. Elevotor Disconnect
71. Fuel Tank
72. Hydraulic ond Electricol Connections
73. Engine Droin Disconnect
74. Combined System Hydroulic Reservoir Filler ond Ground Test Connections, Combined System Accumulator Filler Valve, Engine Control Fuel Filter, Engine Control Lever Linkage
75. External Electric Power

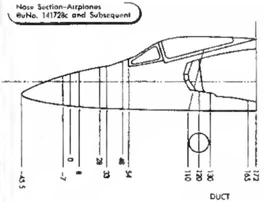


76. Guns, Gun Charging Air Bottles, Boresight Fitting, Ammunition Box Hoist Fitting
77. Flap Accumulotor Air Filler

WING STATIONS DIAGRAM

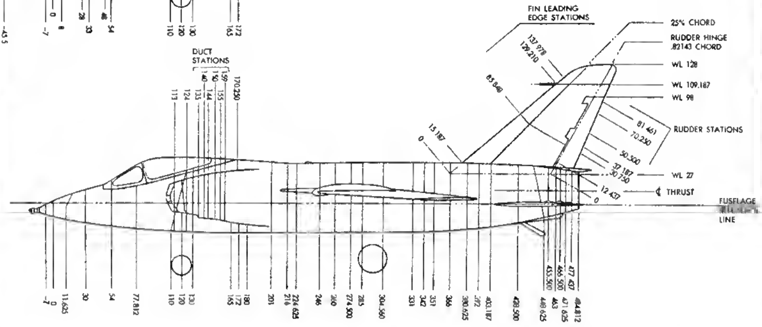
1/72 SCALE



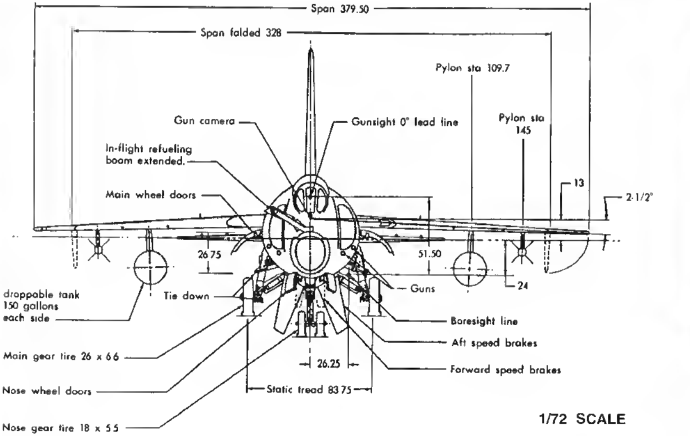


FUSELAGE STATIONS DIAGRAM

NOT TO SCALE



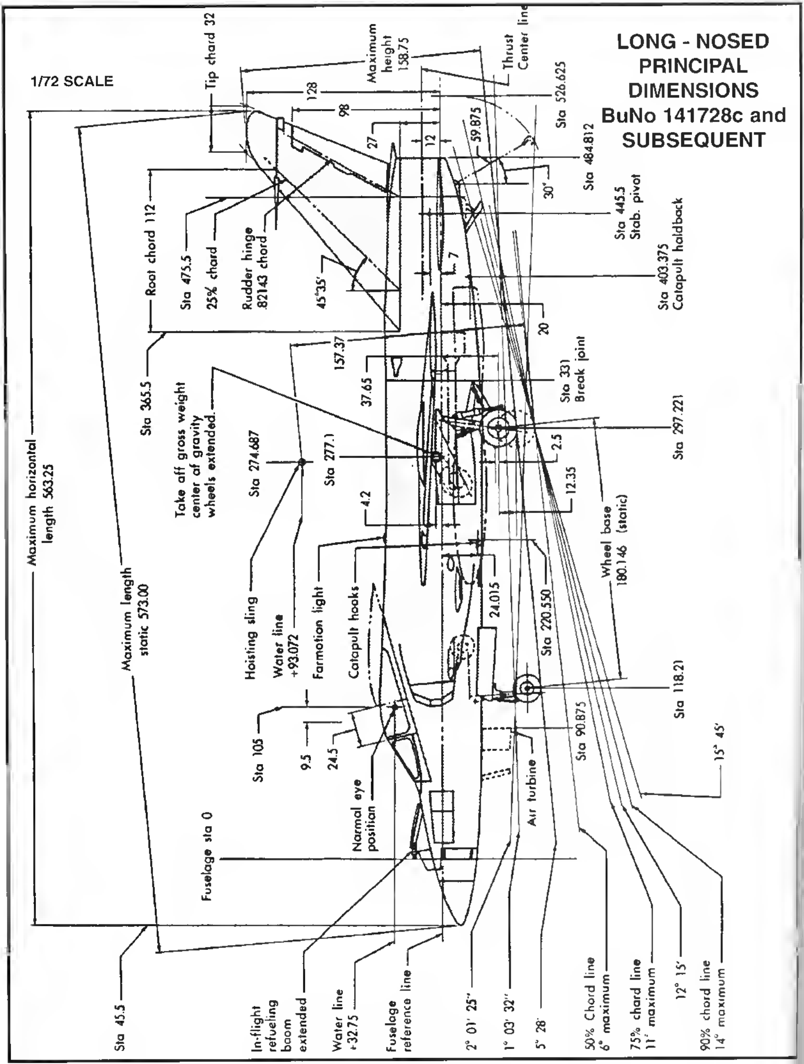
LONG NOSED PRINCIPAL DIMENSIONS BuNo 141728c and SUBSEQUENT

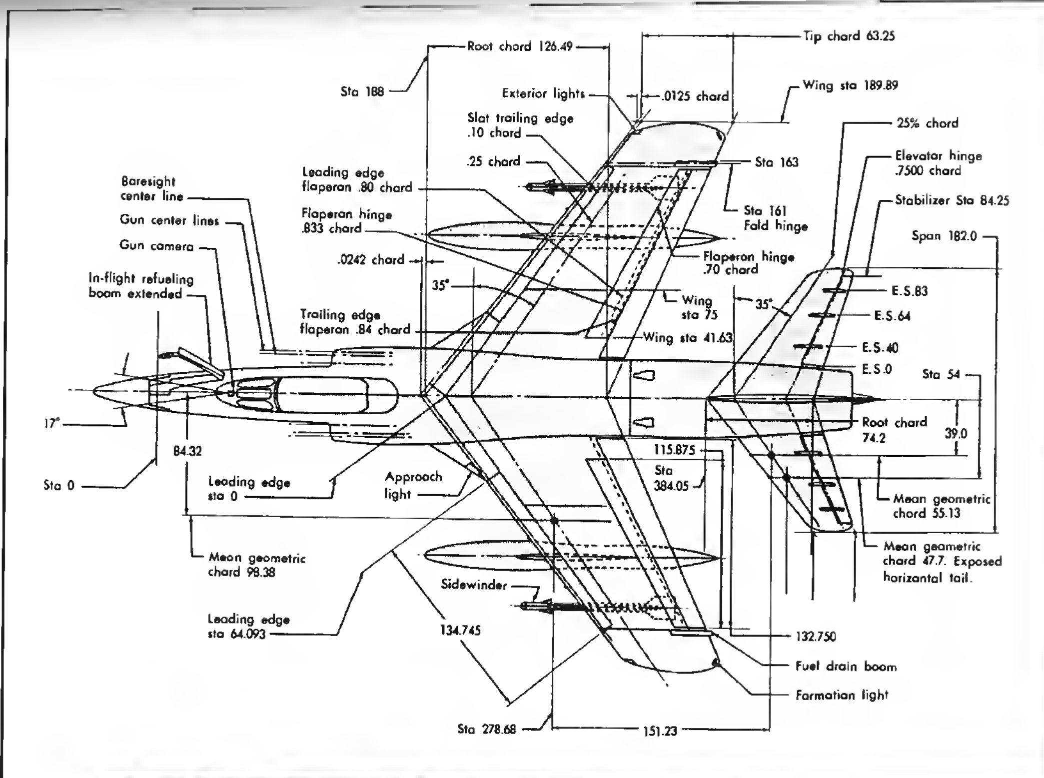


1/72 SCALE

LONG - NOSED PRINCIPAL DIMENSIONS BuNo 141728c and SUBSEQUENT

1/72 SCALE

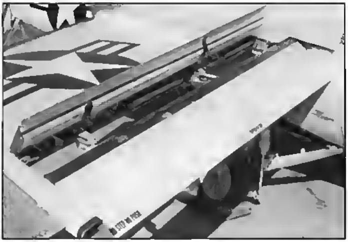




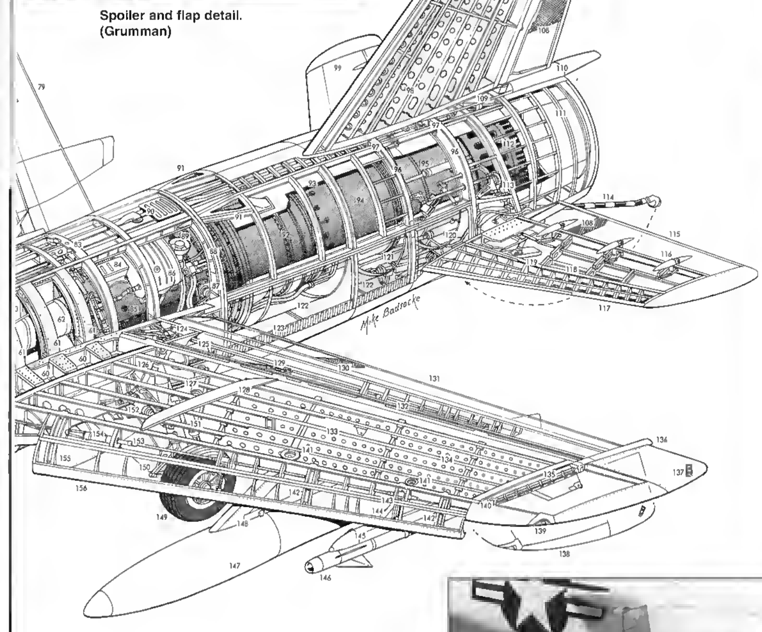
Root chord 126.49
Tip chord 63.25
Sta 188
Exterior lights
.0125 chord
Wing sta 189.89
Slat trailing edge
.10 chord
25% chord
.25 chord
Sta 163
Elevator hinge
.7500 chord
Leading edge
flaperon .80 chord
Sta 161
Fold hinge
Stabilizer Sta 84.25
Baresight
center line
Gun center lines
Flaperon hinge
.833 chord
Span 182.0
Gun camera
Flaperon hinge
.70 chord
.0242 chord
In-flight refueling
boom extended
35°
Wing
sta 75
35°
E.S.83
E.S.64
Trailing edge
flaperon .84 chord
Wing sta 41.63
E.S.40
E.S.0
Sta 54
17°
Root chord
74.2
39.0
84.32
115.875
Sta
384.05
Sta 0
Leading edge
sta 0
Approach
light
Mean geometric
chord 55.13
Mean geometric
chord 47.7. Exposed
horizontal tail.
Mean geometric
chord 98.38
Sidewinder
Leading edge
sta 64.093
134.745
132.750
Fuel drain boom
Formation light
Sta 278.68
151.23

LONGNOSE TIGER CUTAWAY © MIKE BADROCKE 1997

1 Radome
2 AN/APG-56 ranging radar scanner, not fitted operationally
3 Radar transmitter/receiver units
4 Radar mounting bulkhead
5 Refuelling probe housing
6 Flight refuelling probe, extended
7 Probe operating linkage
8 Gun camera
9 Radio junction box
10 Battery
11 Dynamotor
12 Radio and electronics equipment compartment
13 Front pressure bulkhead
14 Forward airbrake panel, open
15 Emergency ram air turbine, extended
16 Airbrake hydraulic jack
17 Cockpit section corrugated inner skin panel
18 Rudder pedals
19 Control column
20 Instrument panel
21 Gunsight
22 Armoured windscreen panels
23 Aft sliding cockpit canopy cover
24 Ejection seat face blind firing handle
25 Headrest
26 Pilot's ejection seat
27 Engine throttle lever
28 Side console panel
29 Cockpit pressure floor
30 Nose undercarriage hydraulic jack
31 Nosewheel leg
32 Twin nosewheels, aft retracting
33 Boarding ladder, extended
34 Nosewheel doors
35 Cannon muzzles
36 Port engine air intake
37 Boundary layer splitter plate
38 Gun feed air bottle
39 Rear avionics and equipment bay
40 Rear pressure bulkhead
41 Cabin air conditioning plant
42 Oxygen bottle
43 Ejection seat launch rails
44 VHF-Nav antenna
45 Canopy pneumatic actuator
46 Canopy and undercarriage emergency air bottles
47 Control rod linkages
48 Forward fuselage main fuel tank, total internal capacity 1,003 US gal (835 Imp gal, 3,795 l)
49 Central ammunition magazine, 150 rounds per gun
50 Ammunition feed chutes
51 20 mm cannon, two per side
52 Cannon bay access door
53 Cartridge case ejection chute
54 Link collector box
55 Catapult strop hook
56 Lower main fuel tank
57 Deck approach lighting
58 Extended chord wing root segment
59 Intake flank integral fuel tanks
60 Wing root attachment fittings
61 Built-up wing attachment fuselage main frames
62 Engine starter housing fairing
63 Intake ducting
64 Dorsal control and cable ducting
65 Starboard wing root joint
66 Wing integral fuel tank
67 Wing fence
68 Leading edge slat hydraulic jack
69 150-US gal external fuel tank
70 Leading edge slat, extended
71 AIM-9 Sidewinder air-to-air missile
72 Slat screw jack and guide rails
73 Folding wing tip segment
74 Starboard navigation light
75 Remote compass transmitter
76 Formation light
77 Fuel jettison
78 Starboard two-segment spoiler (flaperon)
79 Single slotted flap, down position
80 Flaperon operating linkage
81 Flap external hinge
82 Bias strut
83 Forward engine mounting lug fitting
84 Ignition control unit
85 Wright J65-W-18 afterburning engine
86 Engine oil tank 4.36 US gal capacity (3.6 Imp gal, 16 l)
87 Main engine mounting trunion
88 Rear fuselage joint frame (engine removal)
89 Oil filler
90 Engine bay air vent
91 NACA-type cooling air intakes
92 Engine turbine section
93 Internal heat shroud
94 Afterburner ducting
95 Variable area afterburner nozzle actuator
96 Fin/tailplane attachment main frames
97 Fin root attachment joints
98 Multi-spar fin construction
99 Starboard all-moving tailplane
100 Fin leading edge
101 Fin integral fuel tank
102 Pitot head
103 Fin tip aerial fairing
104 UHF aerial
105 Tail navigation light
106 Rudder mass balance
107 Rudder
108 Control surface honeycomb construction
109 Rudder hydraulic actuator
110 Fin root aerodynamic fairing
111 Exhaust nozzle shroud
112 Variable area afterburner nozzle
113 Geared elevator control linkage
114 Deck arrestor hook, stowed in forward position
115 Geared elevator
116 Elevator external hinges
117 Port all-moving tailplane
118 Tailplane construction
119 Retractable tail bumper
120 Tailplane interconnecting yoke
121 Tailplane hydraulic actuator
122 Rear fuselage fuel tankage
123 Fuel tank bay corrugated inner skin
124 Flap/flaperon hydraulic actuator
125 Combined system hydraulic reservoir
126 Main undercarriage leg pivot fixing
127 Drag brace
128 Port wing fence
129 Flaperon bias strut
130 Flap honeycomb construction
131 Port slotted flap
132 Flaperon rib construction
133 Wing panel multi-spar construction
134 Port wing integral fuel tank
135 Wing tip hinge joint, manual folding
136 Fuel jettison
137 Formation light
138 Port wing tip, folded position
139 Port navigation light
140 Wing fold latch
141 Pylon attachment hard points
142 Slat guide rails
143 Slat screw jack
144 Outboard wing pylon
145 Missile launch rail
146 AIM-9 Sidewinder air-to-air missile
147 Port external fuel tank
148 Inboard wing pylon
149 Port mainwheel forward retracting
150 Torque scissor links
151 Undercarriage leg shortening jack
152 Hydraulic retraction jack
153 Rear airbrake panels, port and starboard
154 Leading edge slat hydraulic jack
155 Mainwheel door
156 Port leading edge slat

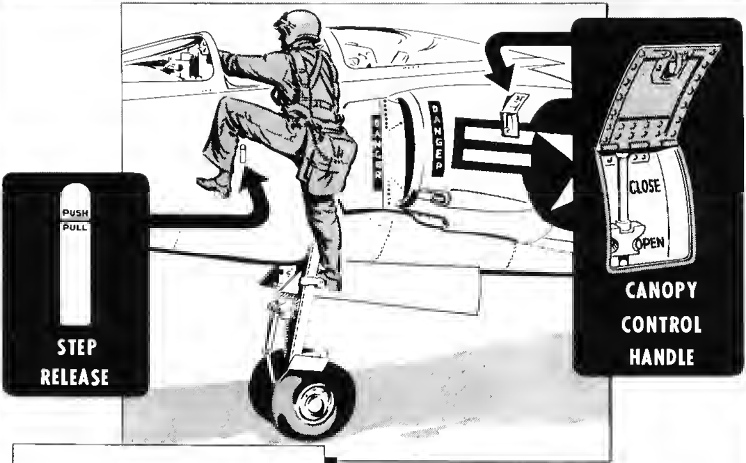


Spoiler and flap detail.
(Grumman)



Slats detail (Grumman)

ENTRANCE TO AIRPLANE



ENTRANCE TO AIRPLANE (STEP PROCEDURE)

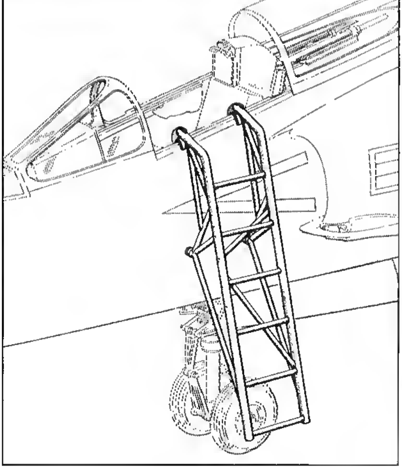
1. Operate step release handle to release boarding ladder and pop-out step.

WARNING
Stand clear of ladder and step when operating step release.

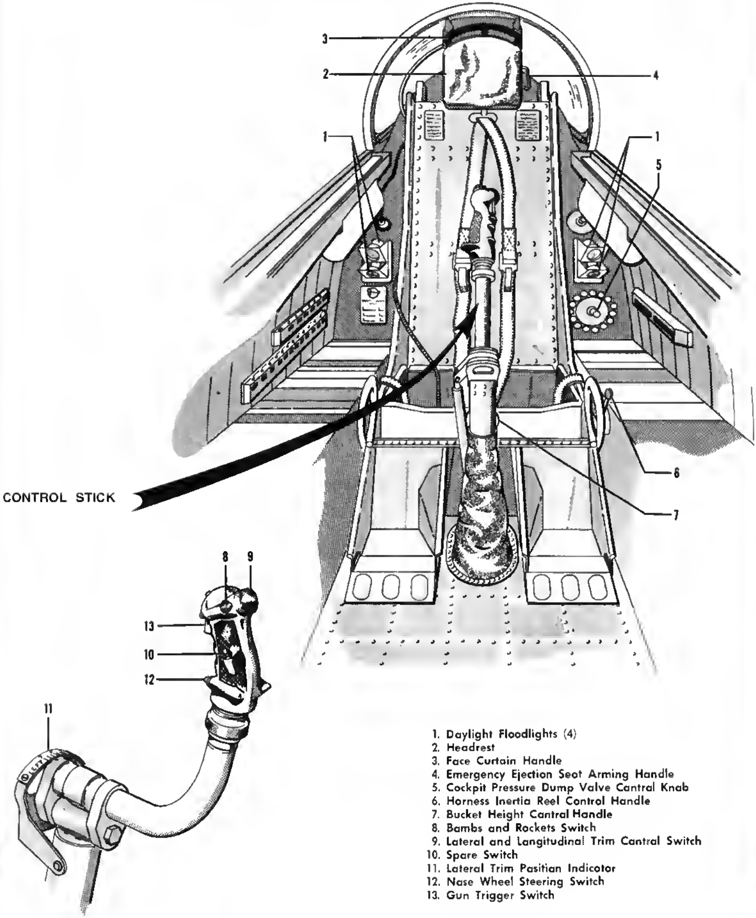
2. Pull canopy control handle (on left intake duct beneath access door) down to open canopy. Secure access door.
3. Place left foot on bottom rung of ladder.
4. Grip duct plate with right hand.
5. Grasp pop-out step with left hand.
6. Swing up to bring right foot to upper rung of ladder, moving right hand to canopy rail.
7. Raise left foot onto pop-out step.
8. Grip windshield frame with left hand.
9. Swing up and enter cockpit with right foot.

CAUTION
The boarding ladder and step cannot be stowed from the cockpit. Before flight, be sure ladder and step are pushed in and stowed by ground crew.

COCKPIT BOARDING LADDER

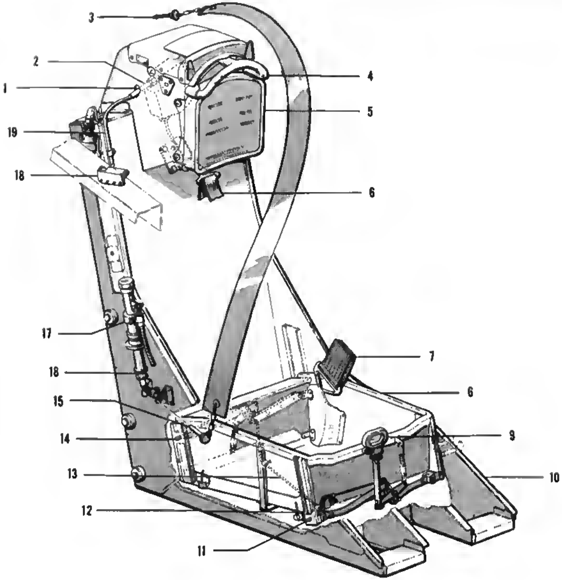


CONTROL STICK AND AFT COCKPIT



1. Daylight Floodlights (4)
2. Headrest
3. Face Curtain Handle
4. Emergency Ejection Seat Arming Handle
5. Cockpit Pressure Dump Valve Control Knob
6. Harness Inertia Reel Control Handle
7. Bucket Height Control Handle
8. Bombs and Rockets Switch
9. Lateral and Longitudinal Trim Control Switch
10. Spare Switch
11. Lateral Trim Position Indicator
12. Nose Wheel Steering Switch
13. Gun Trigger Switch

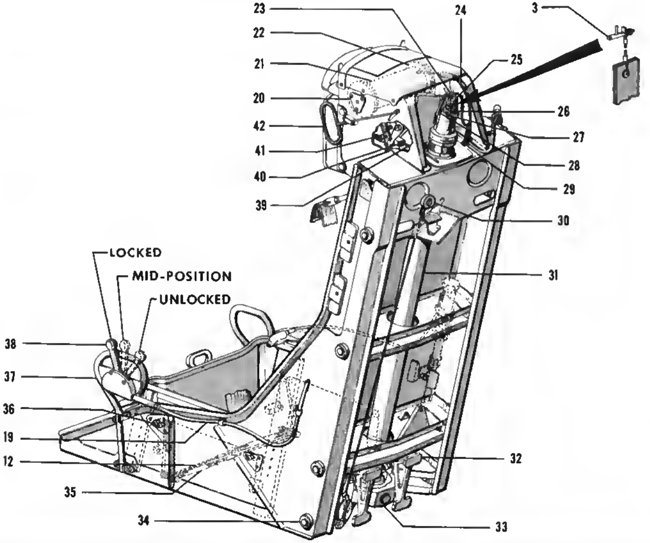
ORIGINAL GRUMMAN EJECTION SEAT

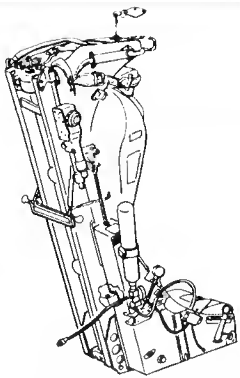


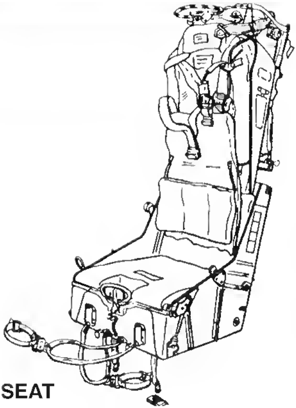
1. Firing Coble Inspection Hole
2. Shoulder Harness Inertia Reel
3. Ejection Seat Ground Safety Lock
4. Foce Curtoin Handle
5. Headrest
6. Shoulder Horness
7. Lop Belt
B. Seat Bucket
9. Bucket Height Cantral (Locking Pin Release)
10. Foot Rest
11. Height Adjustment Locking Pin
12. Bucket Counterbalonce Coble
13. Locking Pin Control Coble
14. Height Adjustment Lacking Pin
15. Autamatic Lap Belt Actuatar Ground Safety Lock
16. Sear Actuotor
17. Automatic Lap Belt Actuotor
1B. Sear Actuator Striker
19. Inertio Reel Control Coble

20. Face Curtain Roller Bearing
21. Face Curtoin Roller Spring
22. Face Curtain Roller
23. Firing Mechanism Yoke
24. Catapult Firing Cable
25. Firing Cable Disconnect
26. Safety Pin
27. Red Cartridge Indicoting Band
28. White Line
29. Cable Spring
30. Seat Disconnect Ring
31. Catdpult Tube
32. Bulkhead Seat Support Fitting
33. Cotapult Support Fitting
34. Seat Roller
35. Bucket Counterbalance Spring
36. Counterbalance Pulley
37. Knee Brace
38. Horness Inertia Reel Control Hondle
39. Canopy Jettison Control Cable
40. Canopy Jettison System Square Tube and Clamshell
41. Conopy Jettison Control Assembly
42. Ejection Seat Emergency Arming Handle

ORIGINAL GRUMMAN EJECTION SEAT

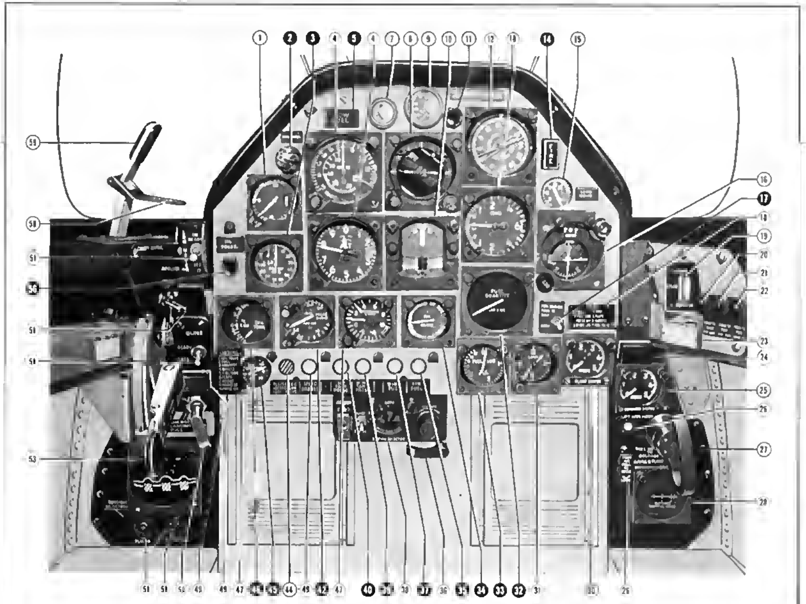




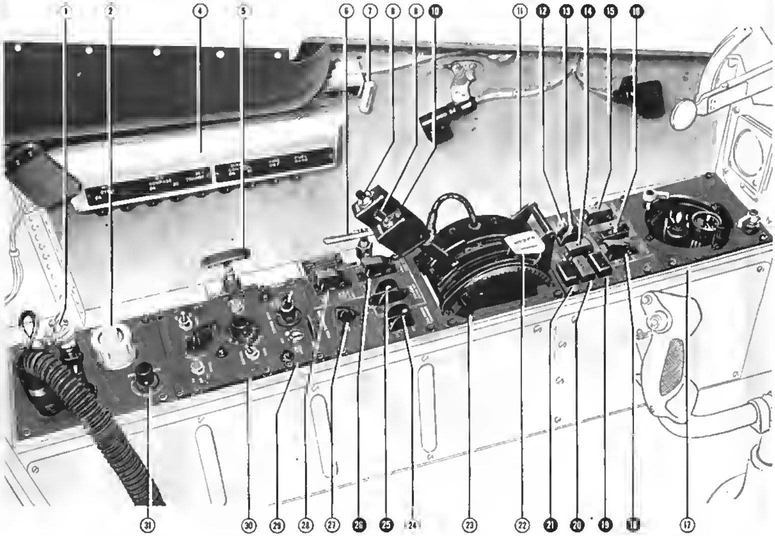


Mk5 GROUND LEVEL REPLACEMENT SEAT

SHORT-NOSED INSTRUMENT PANEL BuNo 138610a through 138645b

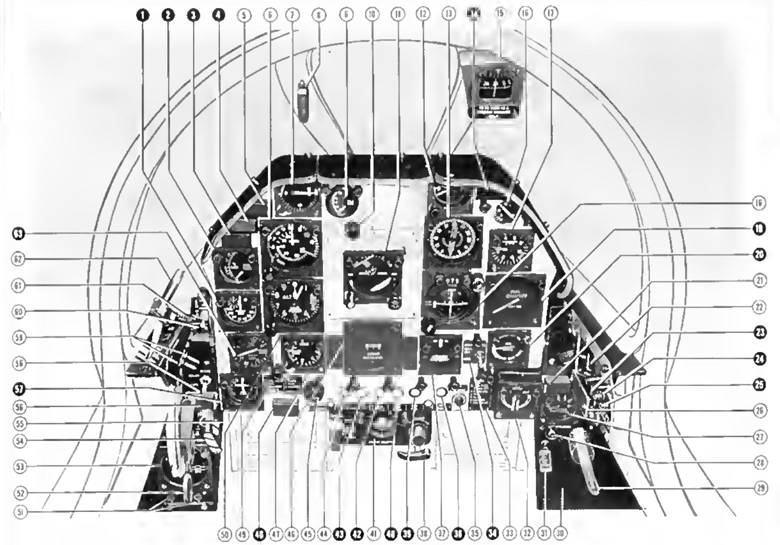


1.) Angle of Attack Indicator.
2.) Ignition Warning light.
3.) Tachometer.
4.) Airspeed Mach # Indicator.
5.) Low Level Fuel Warning Light.
6.) Altimeter.
7.) Radar AFC Meter.
8.) Gyro Horizon Indicator.
9.) Radar Range Meter.
10.) Turn and Bank Indicator.
11.) Radar Tracking Indicator Light.
12.) Course Indicator ID-250/ARN.
13.) Rate of Climb Indicator.
14.) Fire Warning Light.
15.) Longitudinal Trim Position Ind.
16.) Cross-Pointer Course Indicator ID-249A/ARN.
17.) Fuel Quantity Check Switch.
18.) Take Off Check List.
19.) Repeater Oxygen Flow Indicator.
20.) Fire Warning Light Test Switch.
21.) Fuel Quantity Test Switch.
22.) Warning Lights Test Switch.
23.) Compass & Airspeed Cor. Card.
24.) Arresting Hook Warning Light.
25.) Combined System Hyd. Gage.
26.) Arresting Hook Up Control.
27.) Arresting Hook Down Control.
28.) Range Indicator ID-310/ARN.
29.) Foot Heater Diffuser Handle.
30.) Flight System Hydraulic Pressure Gage.
31.) Clock.
32.) Fuel Quantity Indicator.
33.) Fuel Flow Indicator.
34.) Fuel Balance Indicator.
35.) Fin Fuel Indicator.
36.) Rudder Pedals Adj. Handle.
37.) Wing Fuel Indicator.
38.) External Stores Control Panel.
39.) Wing Tank Pressure Indicator.
40.) Aft Tank Pressure Indicator.
41.) Accelerometer.
42.) Pressure Ratio Indicator.
43.) Speed Brakes Position Ind.
44.) Slats, Flaps, Elevators Locked Indicator.
45.) Oil Pressure Indicator.
46.) Tailpipe Temp. Indicator.
47.) Landing Check List.
48.) Landing Gear Warning Light.
49.) Landing Gear Control Lever Down Lock Release Knob.
50.) L.G. Emergency Control Handle.
51.) Wheels/Flaps Position Ind.
52.) Sight Unit Adjustment Knobs.
53.) Landing Gear Control Lever.
54.) Gun Control Switch.
55.) Gun Selection Switches.
56.) Oil Pressure Warning Light.
57.) Armament Master Switch.
58.) Jettison Locking Lever.
59.) Canopy Control Lever.



1.) Anti-Blackout Suit Tube Receptacle.
2.) Anti-Blackout Valve Control Knob.
3.) Deleted.
4.) Circuit Breaker Panel.
5.) Wheel Brakes Emergency Control Handle.
6.) Emergency Hydraulic Turbine Control Handle.
7.) Cockpit Air Diffuser Control Handle.
8.) Microphone Switch.
9.) Speed Brakes Switch.
10.) Power Control Handle.
11.) Catapult Grip.
12.) Boost Pump Cut-Ott Switch.
13.) Engine Fuel Control Switch.
14.) Fuel Tank Emergency Selector Switch.
15.) Wing Fuel Transter Switch.
16.) Fuel Tank Pressure Switch.
17.) Oxygen Control Panel.
18.) Wing Fuel Dump Switch.
19.) High Pressure Fuel Pump Warning Light.
20.) Manual Fuel Control Indicator Light.
21.) Low Pressure Fuel Pump Warning Light.
22.) Flaps Control Handle.
23.) Power Control Lever Friction Control.
24.) Yaw Damper and Rudder Trim Switch.
25.) Afterburner Nozzle Override Switch.
26.) Airstart Ignition Switch.
27.) Directional Trim Control Knob.
28.) Speed Brakes Override Switch.
29.) Radar Control Knob.
30.) Mk. 35 Mod 2 Fire Control Panel.
31.) Radar Tone Volume Control Knob.

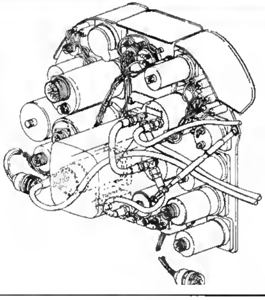
LONG-NOSED TIGER INSTRUMENT PANEL BuNo 141728c and SUBSEQUENT

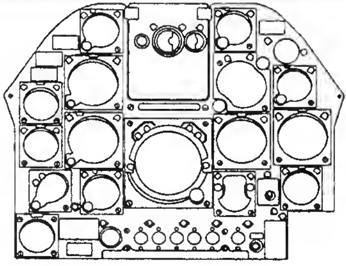


1.) Tachometer.
2.) Tailpipe Temperature Indicator.
3.) Oil Pressure Warning Light.
4.) Ignition Warning Light.
5.) Wheels Warning Light.
6.) Airspeed-Mach Number Indicator.
7.) Angle of Attack Indicator.
8.) Angle of Attack Light Assembly.
9.) Radar Range Meter.
10.) Radar Tracking Indicator Light.
11.) Gyro Horizon Indicator.
12.) Clock.
13.) Course Indicator Id-250/ARN.
14.) Fire Warning Light.
15.) Stand-By (Magnetic) Compass.
16.) Longitudinal Trim Position Indicator.
17.) Accelerometer.
18.) Cross-Pointer Course Indicator ID-249A/ARN.
19.) Fuel Quantity Indicator.
20.) Fuel Balance Indicator.
21.) Arresting Hook Warning Light.
22.) Repeater Oxygen Flow Indicator.
23.) Fire Warning Light Circuit Test Switch.
24.) Fuel Quantity Indicator Test Switch.
25.) Warning Light Test Switch.
26.) Compass and Airspeed Correction Cards.
27.) LOX Quantity Gage.
28.) Arresting Hook Up Control Switch.
29.) Arresting Hook Down Control Handle.
30.) Deleted.
31.) Foot Heat Diffuser Control Handle.
32.) Dual Hydraulic Pressure Gage.
33.) Take-Off Check List.
34.) Fuel Quantity Check Switch.
35.) Gyro Fast Erect Switch.
36.) Fin Fuel Indicator.
37.) Turn and Bank Indicator.
38.) Rudder Pedals Adjustment Handle.
39.) Wing Fuel Indicator.
40.) Wing Tank Pressure Indicator.
41.) External Stores Control Panel.
42.) Aft Tank Pressure Indicator.
43.) Speed Brakes Position Ind.
44.) Slats, Flaps and Elevators Locked Indicator.
45.) Oil Pressure Indicator.
46.) Range Indicator ID-310/ARN.
47.) Rate of Climb Indicator.
48.) Low Level Fuel Warning Light.
49.) Landing Check List.
50.) Altimeter.
51.) Sight Unit Adjustment Knobs.
52.) Landing Gear Control Lever.
53.) Wheels and Flaps Position Indicator.
54.) Landing Gear Emergency Control Handle.
55.) Landing Gear Control Lever Down Lock Release Knob.
56.) Landing Gear Warning Light.
57.) Fuel Flow Indicator.
58.) Gun Control Switch.
59.) Gun Selection Switches.
60.) Armament Master Switch.
61.) Jettison Locking Lever.
62.) Canopy Control Lever.
63.) Pressure Ratio Indicator.

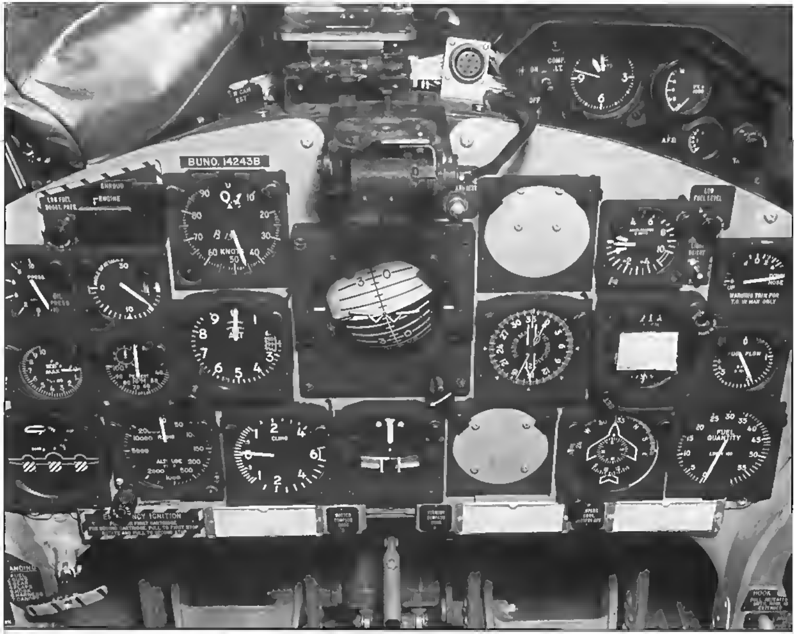
LONG-NOSED TIGER INSTRUMENT PANEL BuNo 141762

Above, The instrument panel of long-nosed Tiger BuNo 141762 awaiting the AN/APS -50 radar gun ranging system, a system never installed in the Tiger. You can see the reflection of the lens of the projection system that places the data in the bullet-proof windshield. (Grumman via Corky Meyer)





LONG-NOSED TIGER INSTRUMENT PANEL BuNo 142438



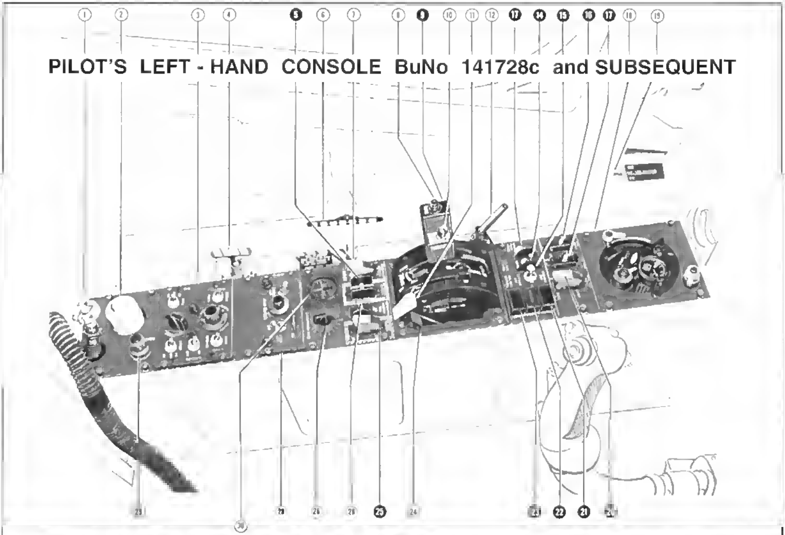
The instrument panel of BuNo 142438 looks considerably different after it was rearranged, when it was known that the AN/APS-50 was not going to be installed. You can see the mounts for the standard lead-computing gunsight at the top of the picture. You can also see that this airplane was used for some experimental flight tests by the sensitive test airspeed instrument installed in place of the airspeed/Mach meter production gage. The silver cloth in the upper left of the picture is the cover for the gunsight. (Grumman via Meyer)

PILOT'S LEFT HAND CONSOLE:

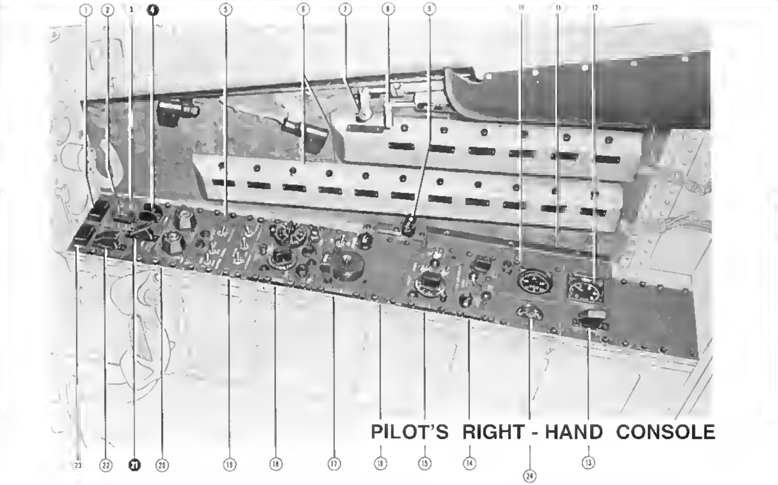
1.) Anti-Blackout Suit Tube Receptacle.
2.) Anti-Blackout Valve Control Knob.
3.) Mk. 44 Mod O Control Box.
4.) Wheel Brakes Emergency Control Handle.
5.) Afterburner Nozzle Override Switch.
6.) Emergency Hydraulic Turbine Control Handle.
7.) Speed Brakes Override Switch.
8.) Microphone Switch.
9.) Power Control Lever.
10.) Speed Brakes Switch.
11.) Flaps Control Handle.
12.) Catapult Grip.
13.) Boost Pump Cut-Off Switch.
14.) Engine Fuel Control Switch.
15.) Fuel Tank Emergency Selector Switch.
16.) Wing Fuel Transfer Switch.
17.) Fuel Tank Pressure Switch.
18.) Oxygen Control Panel.
19.) Exterior Lights Auxiliary Master Switch.
20.) Wing Fuel Dump Switch.
21.) High Pressure Fuel Pump Warning Light.
22.) Manual Fuel Control Indicator Light.
23.) Low Pressure Fuel Pump Warning Light.
24.) Power Control Lever Friction Control.
25.) Airstart Ignition Switch.
26.) Yaw Damper and Rudder Trim Switch.
27.) Directional Trim Control Knob.
28.) Radar Control Panel.
29.) Radar Tone Volume Control Knob.
30.) Cockpit Pressure Altimeter.

PILOT'S RIGHT HAND CONSOLE:

1.) Generator Warning Light.
2.) D-C Power Switch.
3.) Pitot Heater Switch.
4.) Engine Master Switch.
5.) Exterior Lights Control Panel.
6.) Circuit Breaker Panels.
7.) Canopy Defroster Control Handle.
8.) Cockpit Air Diffuser Control Handle.
9.) Hydraulic System Isolation Control.
10.) Cockpit Pressure Altimeter BuNo 138610a through 138645b. Voltmeter BuNo 141728c and up.
11.) Map Case.
12.) Pneumatic Pressure Gage.
13.) Daylight Floodlights Switch.
14.) S-2 Remote Compass Contol Panel BuNo 138610 through 138645. MA-1Compass Cont. Panel 141728 & up.
15.) IFF Control Panel AN/APX-6B.
16.) Coder Control Panel AN/APA-89.
17.) VHF Nav. Control Panel AN/ARN-14E or UHF Nav. Control Panel AN/ARN-21.
18.) UHF Com. Control Panel AN/ARC-27A.
19.) Interior Lights Control Panel.
20.) Air Conditioning System Control Panel.
21.) Fuel Master Switch.
22.) Instrument Power Switch.
23.) Instrument Power Warning Light.
24.) Voltmeter BuNo 138610a to 138645b.

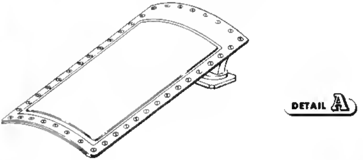


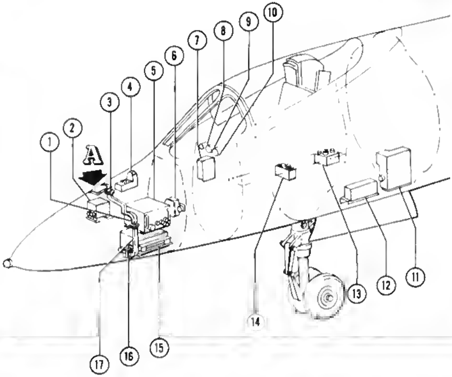
PILOT'S LEFT - HAND CONSOLE BuNo 141728c and SUBSEQUENT



PILOT'S RIGHT - HAND CONSOLE

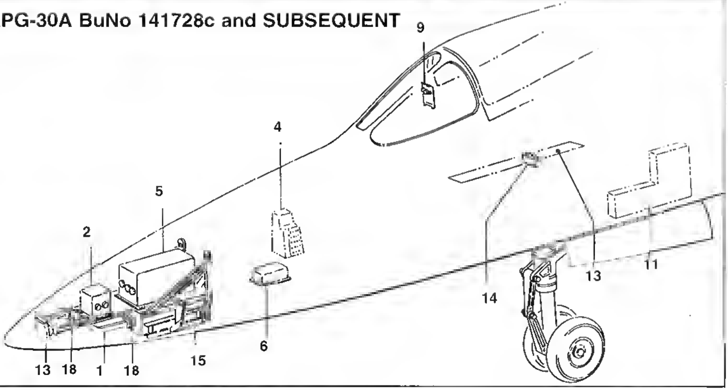
SHORT-NOSED TIGER AN/APG-30 RANGE-ONLY RADAR SYSTEM LOCATION



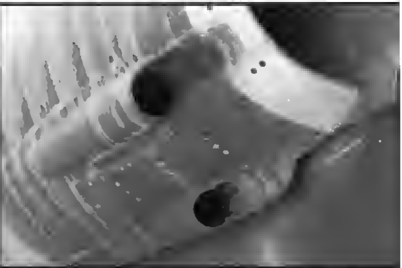


LEGEND AT LEFT & BELOW:
1.) Waveguide 98SC1085-1 (G.A.E.C.).
2.) Voltage Regulator CN-112 APG-30.
3.) Range-only Radar Antenna 98R1172.
4.) AC Junction Box 98E1912/3903.
5.) Power Supply-Range Computer PP-493/APG-30 and Mount MT-739U.
6.) Radar Test and Junction Box 98R1090.
7.) Aircraft Fire Control System Junction Box 98E1910.
8.) Off target Light AN3157-2.
9.) Range Meter 98SP1240.
10.) AFC Meter 98SP1241.
11.) Left Main Junction Box 98E1885/3906.
12.) Auxiliary Circuit Breaker Box 98E1909.
13.) Tone Pat.
14.) Control Box C-775/APG-30.
15.) Frequency Converter-Transmitter RT-181/RT-322/APG-30.
16.) Directional Coupler 98SP2238 and Quick Disconnect 98SP2237.
17.) Flexible Waveguide 98SP2236.
18.) Mica Window.
19.) Antenna AT-561/APG-30.

AN/APG-30A BuNo 141728c and SUBSEQUENT



20MM CANNON INSTALLATION



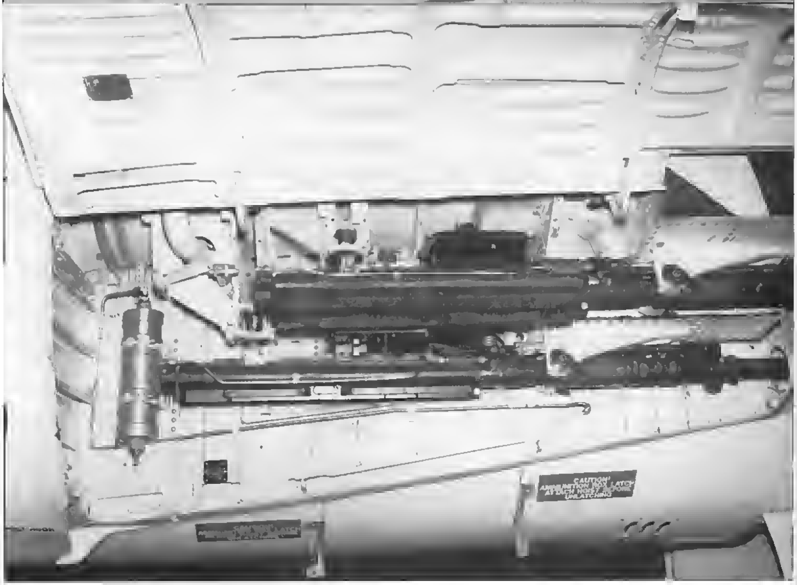
Top left, head-on view of original 20mm cannon installation on the Tiger's right side. (Grumman)

Top right, right side 20mm cannon ports minus guns. (Ginter)

Above, a detail shot of the chin gun flash suppressors later installed in the Tiger. These flash suppressors made night gun firing tolerable. Before they were added, it was impossible to see anything for a long time after firing the guns at night. (Grumman via Corky Meyer)

At right, a positive and strong method, albeit complicated, of leveling the aircraft for gun firing tests is demonstrated on a short-nosed Tiger. 14,500 rounds were fired in these ground tests. The fuselage to the right was a mock-up used for doing experimental gunnery changes prior to firming up production changes. (Grumman via C. Meyer)

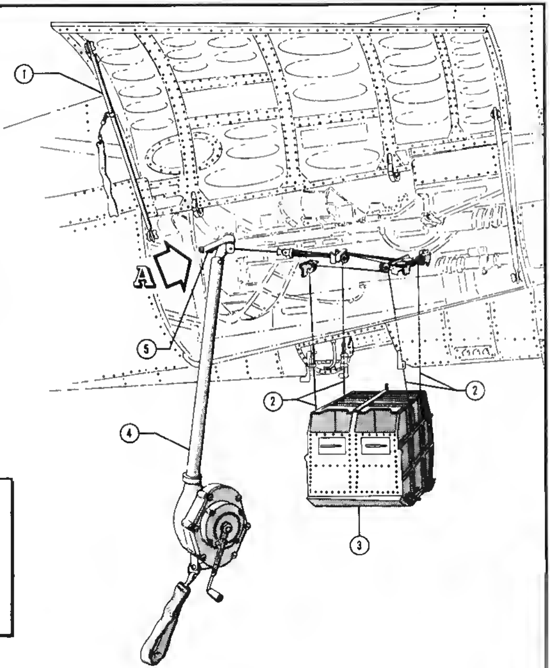
FIIF-1 TIGER 20MM CANNON INSTALLATION



20MM AMMUNITION BOX HOISTING

At left, the 20mm ammo box which contained 500 rounds of ammunition has been lowered to the ground. Note ammunition ejector chutes below the National Insignia. (Grumman via Corky Meyer)

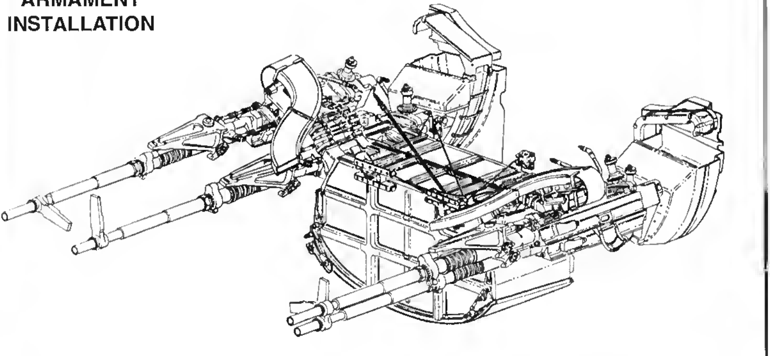
At left bottom, open right hand cannon installation. The gun charger is the cylinder at the rear of the guns. Note the catapult holdback fitting at the aft lower end of the gun bay. (Grumman VIA Corky Meyer)



DETAIL A
Method of Stowing Hoisting Cables

1. Gun Access Door Strut
2. Hoisting Cable
3. Ammunition Box
4. Bomb Hoist
5. Bomb Hoist Attachment Fitting
6. Gun Mount Rear Frame
7. Cable Attaching Pin
8. Stowage Tab

ARMAMENT INSTALLATION



Above, F11F-1 during armament mounting tests. A 500 pound bomb is mounted to the outer wing pylon and a large nuclear "Shape" is being positioned for mounting on the inboard pylon. Both weapons were painted bright yellow. Both of these weapons were tested to their supersonic limits. (Grumman via Corky Meyer) At left, a mock-up of the Eagle missile was tried on a production Tiger in preparation for possible installation. It fit the space and weight limitations on the wing station but the avionics were too sizable to fit in the nose of the airplane.The missile was to have had an 80 mile range and all-weather capability. (Grumman via Corky Meyer) Below, a GAU-7 rocket pack is mounted on the outer wing pylon and a GAU-9 rocket pack is mounted on the inner pylon. (Grumman via Corky Meyer)

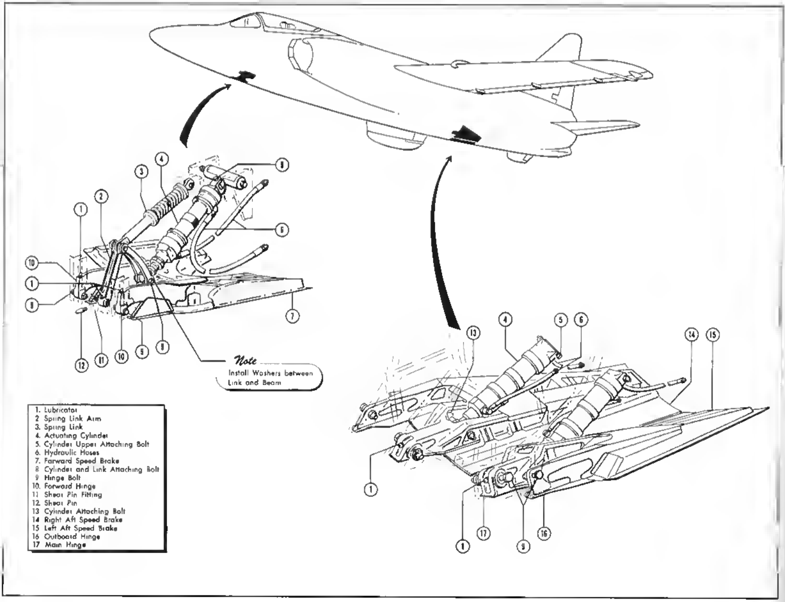
Above, three armament test Tigers in flight. From left to right: Four AIM-9 Sidewinders, two 150 gallon drop tanks and two Sidewinders, two Mk. 82 1,000 pound bombs and two GAU-7 2.75" rocket packs.The pilots were John Norris, Tom Attridge, and Ralph Donnell. (Grumman via Corky Meyer)

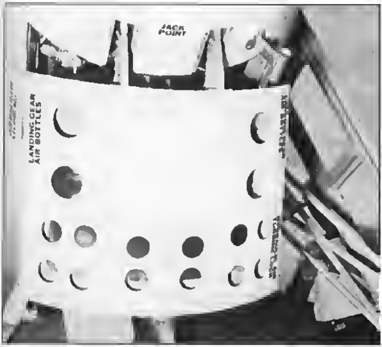
Above, belly view of the Tiger showing the mounting position of four Sidewinders. It also shows the shape of the Tiger's area-rule fuselage. The purpose of the area-rule was to make the cross-section of the wing/fuselage areas have a smooth curve of air flow as the airplane passes through it. Its proof was never determined in the Tiger program as it never got past the Mach number where it was supposed to take effect. (Grumman via Corky. Meyer)

Below, the #2 Super Tiger next to a VF-21 F11F set up for evaluation by a Japanese team at Edwards AFB. The Super Tiger had two AIM-9 Sidewinders and two Martin Orlando ASM-N-7 radio-guided Bullpup air-to-ground missiles on a lengthened inner wing pylon. (Grumman via Corky Meyer)

SPEED BRAKES

Above, a good shot early Tiger's speed brakes after they had the hinge line vented to prevent buffeting. The short and long-nose Tigers had slightly different front speed brakes because of the difference in nose cross section. (Grumman via Meyer)





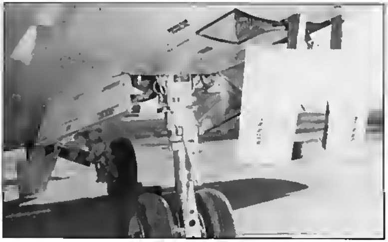
SPEED BRAKES

Above, front speed brake as tested on BuNo 138604 on flights five through thirteen and on flight number sixteen. The rectangular brake and its perforations were dropped for a solid split brake design. (Grumman))

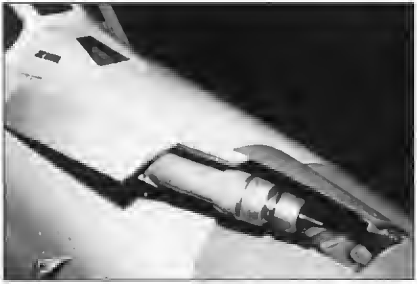
Above right, a solid rectangular brake was tested on BuNo 138604 on flights fourteen and fifteen. (Grumman)

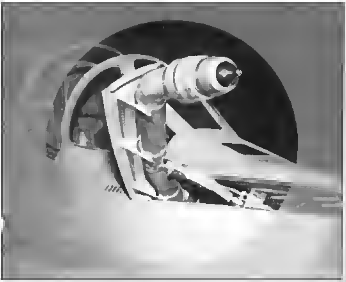
At right, a solid split brake as seen on one of the Super Tigers was similar to that of the final long-nosed Tiger design. (Grumman)

Below, the aft speed brakes of BuNo 13804 as tested on flights three through fourteen. The production aft speed brakes were identical except that they lacked perforations. (Grumman)

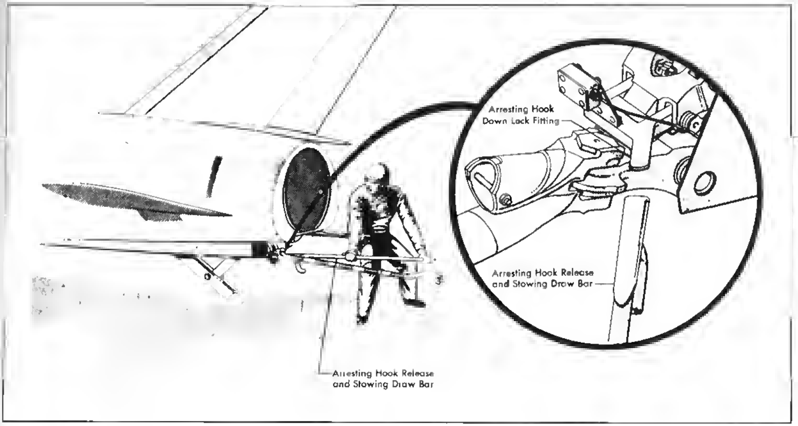


Top, the first test of the in-flight refueling probe of the short-nosed Tiger BuNo 138614 on flight T-29. (Grumman via Corky Meyer) Above, Naval Air Test Center long-nosed Tiger BuNo 141729 is refueled via its Cobra boom from NATC AJ Savage BuNo 124158 in September 1957. (National Archives) Below, retractable refueling boom on the long-nosed Tiger in the partially open and completely open position. Note location of the gun camera window at the base of the canopy. (Grumman)

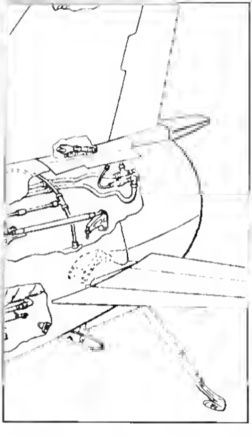


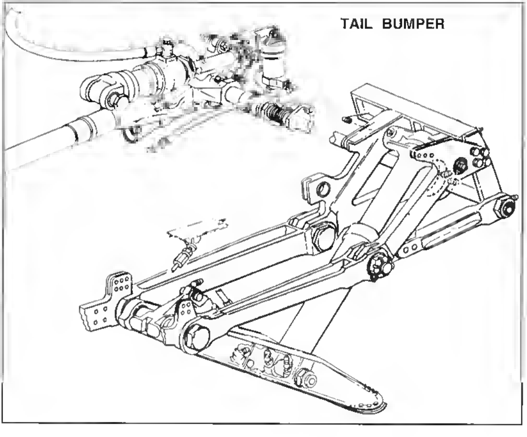


ARRESTING HOOK AND TAIL BUMPER

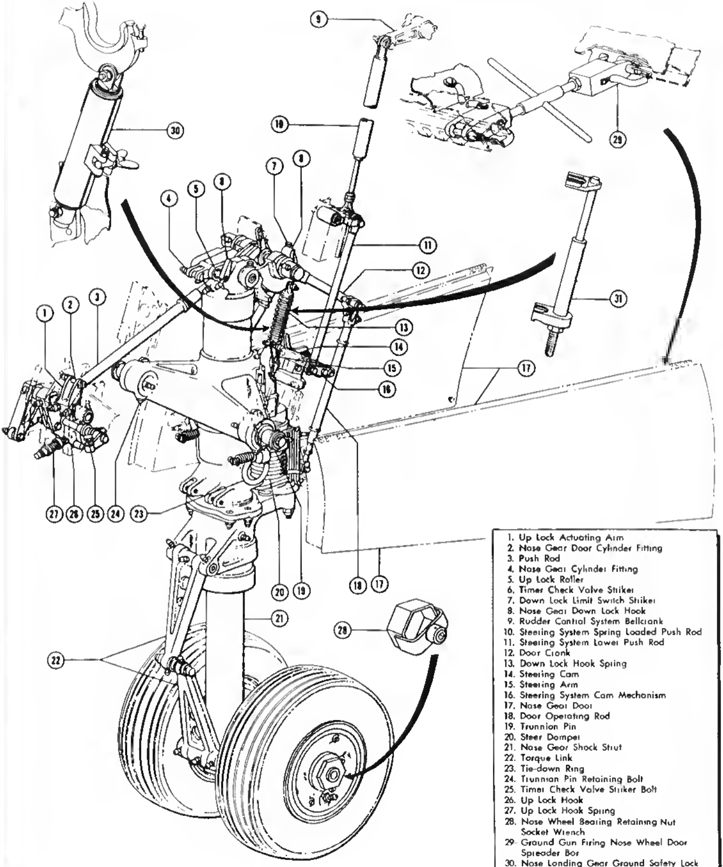


ARRESTING HOOK STOWING: The arresting hook must be stowed manually. When the airplane taxis out of the arresting gear, the hook will be in the stinger position, raised approximately parallel with the deck. To stow the hook, slide the flat open end of the arresting hook release and stowing draw bar over the finger shaped portion of the down-lock fitting at the right side of the hook trunnion and move the down-lock fitting up. This will cause the hook to drop to the deck. Hook the arresting hook near the shank with the curved portion of the draw bar and swing the arresting hook to the right and forward in an arc parallel to the stabilizer. Rotate the hook point so that it faces up and raise the hook into the stowage cavity until its lug engages the up-lock hook.



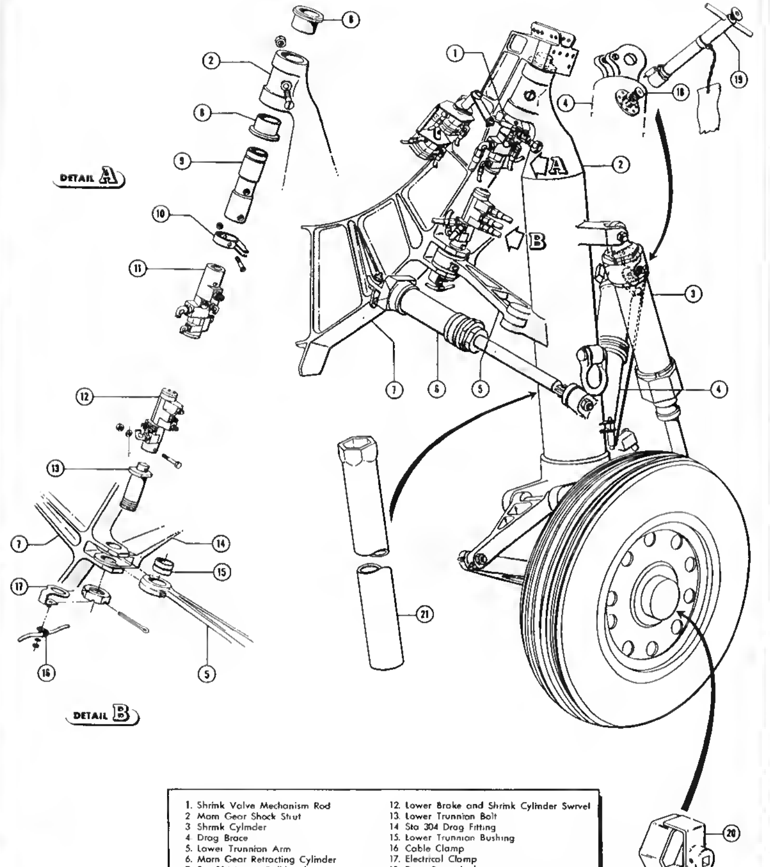


NOSE GEAR INSTALLATION



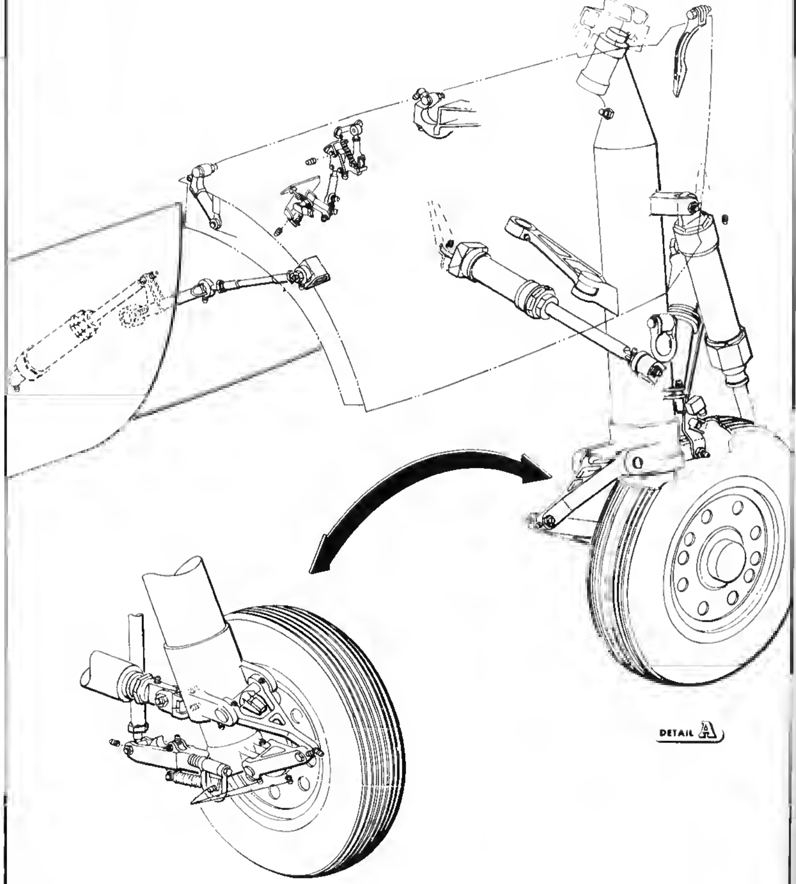
1. Up Lock Actuating Arm
2. Nose Gear Door Cylinder Fitting
3. Push Rod
4. Nose Gear Cylinder Fitting
5. Up Lock Roller
6. Timer Check Valve Striker
7. Down Lock Limit Switch Striker
8. Nose Gear Down Lock Hook
9. Rudder Control System Bellcrank
10. Steering System Spring Loaded Push Rod
11. Steering System Lower Push Rod
12. Door Crank
13. Down Lock Hook Spring
14. Steering Cam
15. Steering Arm
16. Steering System Cam Mechanism
17. Nose Gear Door
18. Door Operating Rod
19. Trunnion Pin
20. Steer Damper
21. Nose Gear Shock Strut
22. Torque Link
23. Tie-down Ring
24. Trunnion Pin Retaining Bolt
25. Timer Check Valve Striker Bolt
26. Up Lock Hook
27. Up Lock Hook Spring
28. Nose Wheel Bearing Retaining Nut Socket Wrench
29. Ground Gun Firing Nose Wheel Door Spreader Bar
30. Nose Landing Gear Ground Safety Lock
31. Nose Wheel Down Lock Spring Compressor

MAIN LANDING GEAR INSTALLATION



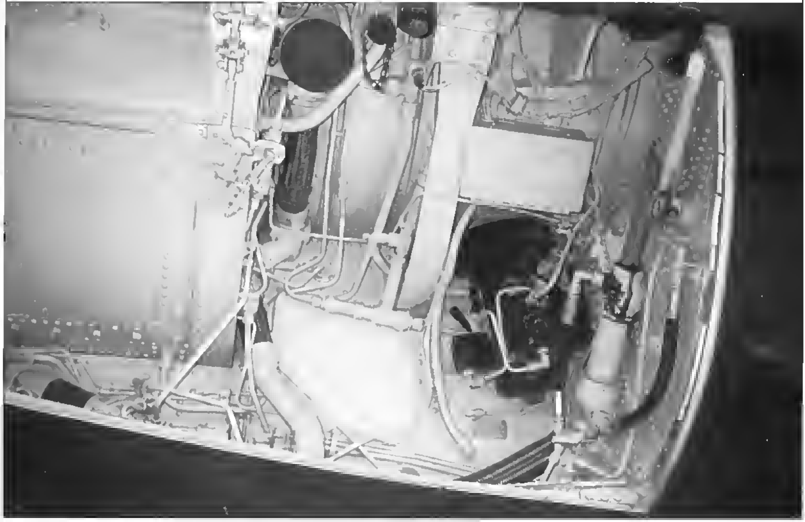
1. Shrink Valve Mechanism Rod	12. Lower Brake and Shrink Cylinder Swivel
2. Main Gear Shock Strut	13. Lower Trunnion Bolt
3. Shrink Cylinder	14. Sta 304 Drag Fitting
4. Drag Brace	15. Lower Trunnion Bushing
5. Lower Trunnion Arm	16. Cable Clamp
6. Main Gear Retracting Cylinder	17. Electrical Clamp
7. Sta 304 Lower Bulkhead	18. Drag Brace Lock
8. Upper Trunnion Bushing	19. Main Landing Gear Ground Safety Lock
9. Upper Trunnion Pin	20. Main Wheel Bearing Retaining Nut Socket Wrench
10. Upper Trunnion Pin Welded Arm	21. Shock Strut Metering Pin Wrench
11. Upper Brake and Shrink Cylinder Swivel	

MAIN GEAR AND GEAR DOOR LINKAGE



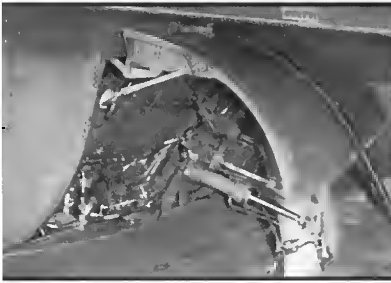
RIGHT MAIN LANDING GEAR WELL DETAIL LOOKING AFT

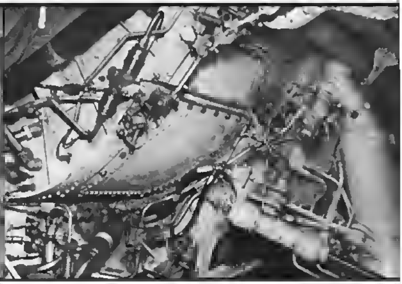
RIGHT MAIN LANDING GEAR WELL DETAIL LOOKING FORWARD



MAIN LANDING GEAR LOOKING AFT

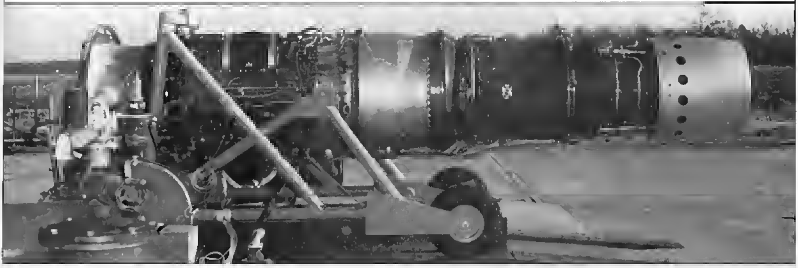
LEFT MAIN LANDING GEAR WELL LOOKING AFT

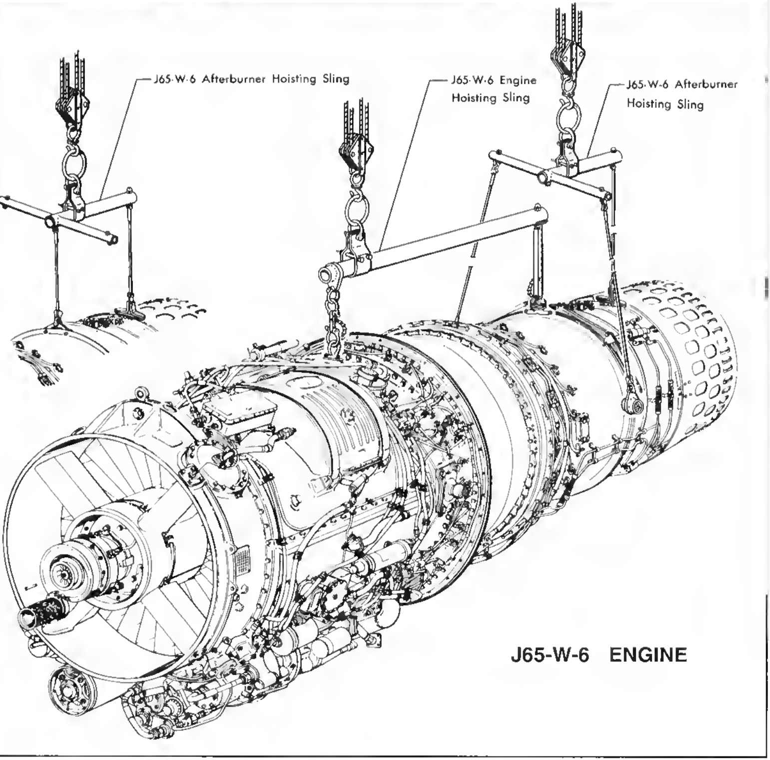




LEFT MAIN GEAR WELL LOOKING FORWARD

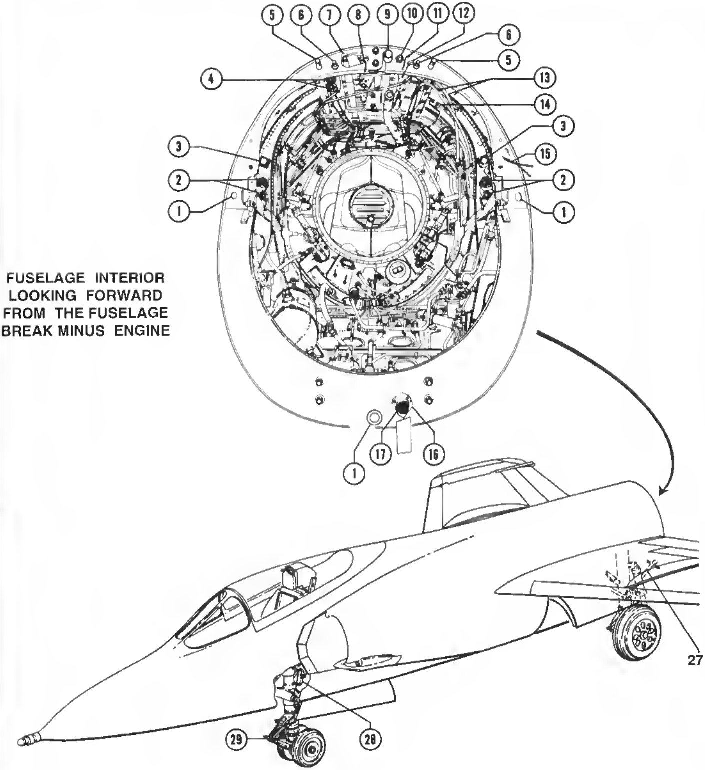
CURTISS WRIGHT J65-W-18 ENGINE





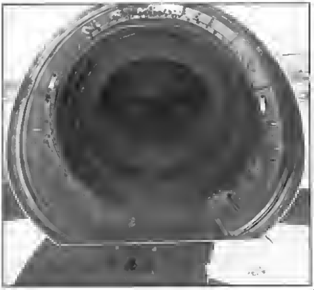
J65-W-6 ENGINE

TAIL SECTION REMOVAL

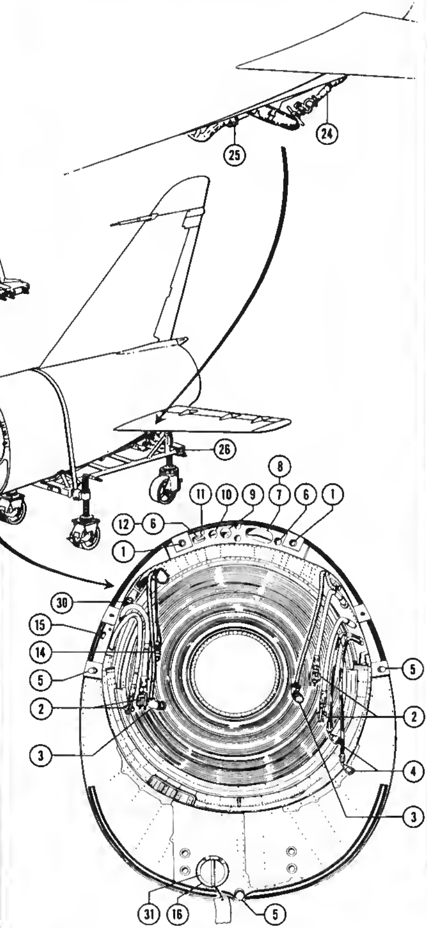


1. Tail Disconnect Stud Hole
2. Hydraulic Disconnects
3. Electrical Connector
4. Fuel Head Sensing Disconnects
5. Tail Disconnect Stud
6. Antenna Disconnect
7. Stabilizer Push Rod
8. Rudder Cable
9. Fuel Vent Line
10. Fuel Tank Pressurizing Air
11. Arresting Hook Cable
12. Rudder Cable
13. Pitot Static Lines
14. Fuel Probe Electrical Connectors
15. Elevator Shift Cables
16. Fuel Transfer Disconnect
17. Fuel System Aft Cell Transfer Hose Sealing and Protective Cap
18. Sta 331 Bulkhead
19. Fuselage Tail Section Disconnect Tool
20. Spacer
21. Keel Disconnect Fitting
22. 5/32 inch Control Cable Quick Disconnect Tool
23. 1/8 inch Control Cable Quick Disconnect Tool
24. Tail Bumper Retaining Link
25. Arresting Hook Tie-back
26. Fuselage Tail Section Installation and Removal Cradle
27. Main Landing Gear Ground Safety Lock
28. Nose Landing Gear Ground Safety Lock
29. Nose Landing Gear Shock Strut Positioning Collar
30. Pitot Static Line Guides
31. Fuel System Aft Cell Disconnect Valve Sealing and Protective Cap

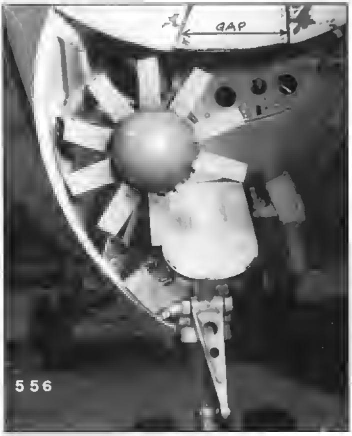
TAIL SECTION REMOVAL



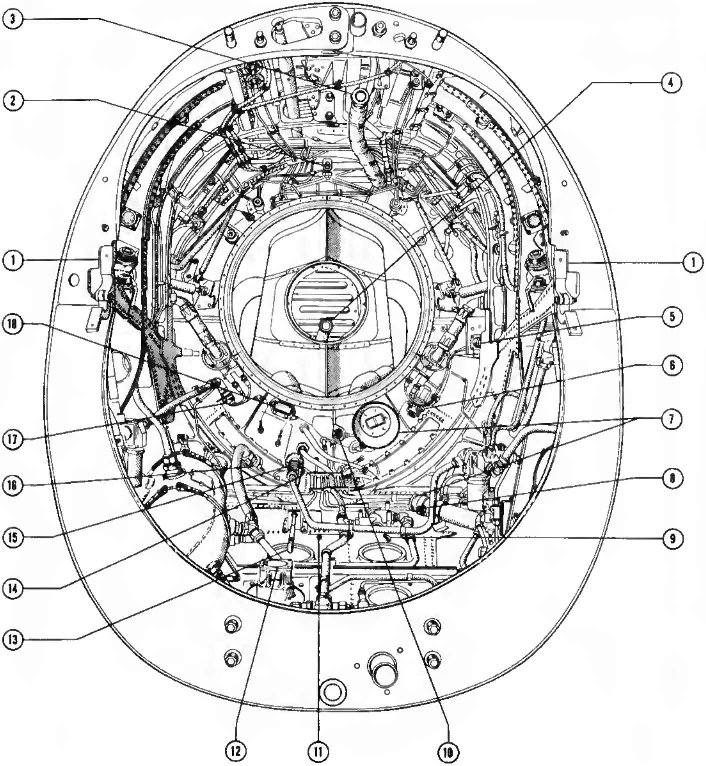
(Ginter)



RAM AIR TURBINE

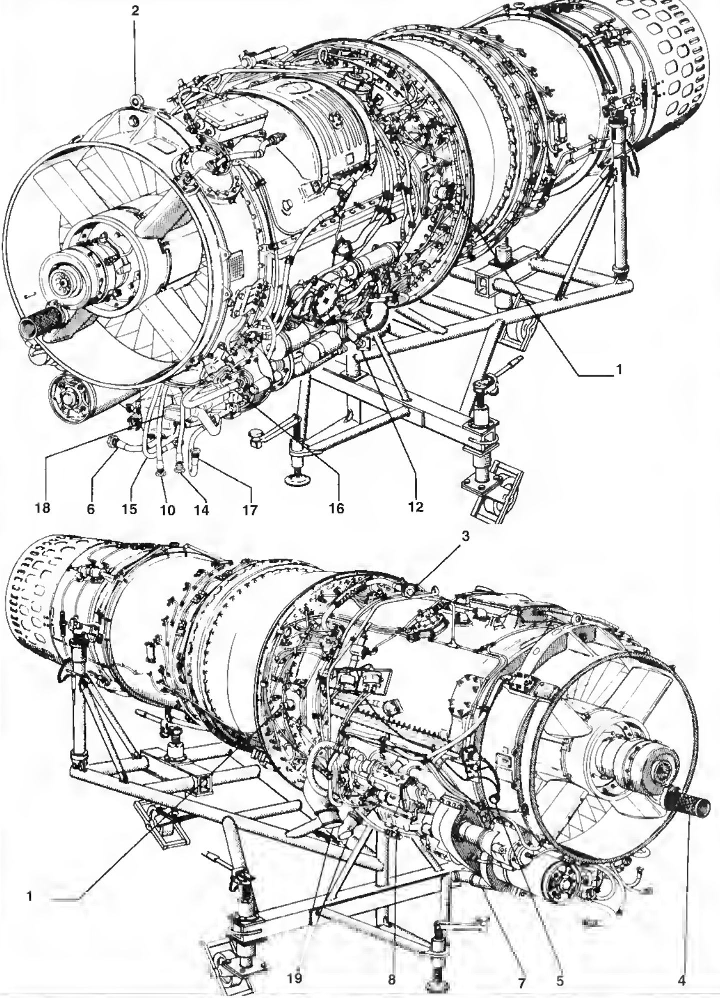


ENGINE INSTALLATION FITTINGS FORWARD FUSELAGE



1. Main Mount
2. Forward Mount
3. Air Conditioning Bleed Air Line
4. Starter Air Line
5. Electrical Cable Connector
6. Flight Hydraulic System Suction Line
7. Generator Cooling Duct
8. Generator Cooling Ejector Line
9. Hydraulic Pump Seal Drain Line
10. Flight Hydraulic System Case Drain Line
11. Starter Seal Drain Line
12. Engine Fuel Inlet Line
13. Power Control Linkage
14. Combined Hydraulic System Case Drain Line
15. Flight Hydraulic System Pressure Line
16. Combined Hydraulic System Suction Line
17. Combined Hydraulic System Pressure Line
18. Hydraulic Pumps Cooling Duct
19. Oil Vapor Overboard Ducts

ENGINE INSTALLATION FITTINGS



Above, three Grumman cats. The Tiger's pilot was Ralph Donnell, the red colored Bearcat's pilot was Roger Kahn, and the Cougar's pilot was Vince Fastenella. (Grumman) Below, classic planform of F11F banks away from the F8F. (USN)

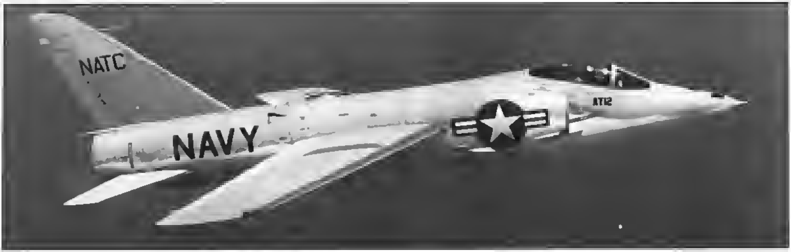
NAVAL AIR TEST CENTER

As the Navy's main aeronautical testing facility, NATC is responsible for determining a new aircraft's suitability for use with the fleet.

Above, System Test (ST) Tiger BuNo 138618 landing during carrier suitability tests aboard the USS Saratoga. These tests went very smoothly. Below, two Flight Test (FT) Tigers BuNos 138614 & 138618 are being hoisted aboard the USS Forestal prior to carrler suitability tests. 618 In the foreground had a da-glo red tail and nose. (Grumman via Corky Meyer)

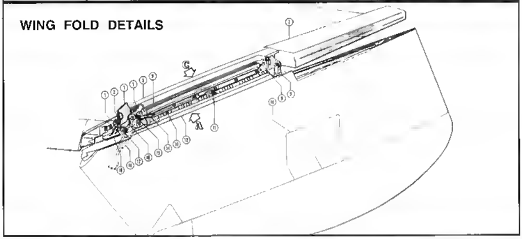

60
630
NAVY


618
ST

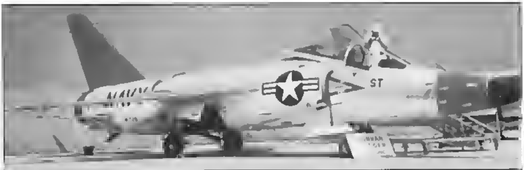


Above left, BuNo 138618 and 138630 from System Test (ST) at NATC alongside the island of the USS Saratoga during carrier suitability trials. (MFR)
Below left, 138618 prior to launch from CVA-60. Note the catapult bridle vee cable attached to the catapult hooks on the bottom of the fuselage. This picture shows that the forces from the catapult go almost directly through the center of gravity of the aircraft, which is necessary to keep the aircraft from pitching during and after the CAT shot. (Grumman via Corky Meyer)

Above, Armament Test (AT) Tiger BuNo 138617 over NAS Patuxent River on 25 June 1956. The aircraft is gull-grey and white. (National Archives)
At right, System Test Tiger BuNo 138626 with wing tips folded in 1960. The nose, wing tips, horizontal stabilizers, and tail were da-glo red. Note the stylized black and white "S" for System Test on the tail. (via Berger)
Bottom, Armament Test (AT) Tiger BuNo138617 at Patuxent in 1956. (via Fred Roos)
At right, flight manual illustration of the Tiger's un-complicated wing fold mechanism. (USN)



NAVAL TEST PILOT SCHOOL



Above, long-nosed Tiger BuNo141729 in NATC markings with da-glo nose, wing tips, horizontal tail, and vertical tail. (via Ron Picciani)

At right, Test Pilot School (TPS) F11F-1 BuNo 138628 with TPS emblem on the tail at NAF Litchfield Park on 18 March 1963. (William Swisher) At right, Test Pilot School Y/F11F-1 BuNo 138629 at NAF Litchfield Park on 18 March 1963. (William Swisher) Below, Test Pilot School F11F-1 BuNo 138621 with TPS insignia on the upper tall at NAF Litchfield Park on 18 March 1963. Note red and white striped nose probe and unusual concooning of the cockpit in the open position. (William Swisher)

AIR DEVELOPMENT SQUADRON THREE VX-3

Air Development Squadron Three (VX-3) was established on 20 November 1948, at Naval Air Station Atlantic City, New Jersey. Two squadrons from CVLG-1, VF-1L and VA-1L, were merged to form the new squadron.

VX-3 was assigned the following missions:

1.) Evaluate by operational test, and report on the new and standard types of aircraft, airborne equipment and methods in accordance with assigned projects, In general, projects will emphasize carrier applications of weather, altitude and loading.

2.) Recommend methods for the most effective tactical employment of new and standard equipment and craft evaluated.

3.) Recommend training procedures, training aids and countermeasures for new and standard equipment and methods evaluated.

4.) Assist, with services and facilities, other naval and extranaval activities or agencies as directed and maintain liaison with agencies engaged in projects of mutual interest.

5.) Maintain, through training and indoctrination, maximum combat operational readiness commensurate with the discharge of the above.

Consistent with its mission, VX-3 flew virtually every new carrier-based naval aircraft produced in the 1950s, including the Tiger. The squadron received its first Tigers in February 1957. 1957 and 1958 were busy years for VX-3 as it was also heavily committed to the F8U Crusader and the F4D Skyray program. In April 1957, VX-3 became the first Navy squadron to operate these three new types off the deck of a carrier when the squadron went aboard the USS F. D. Roosevelt for carrier qualifications and advanced work on TACAN systems. Then, during the last week in June 1957, VX-3 took its F4D-1s and F11F-1s aboard the USS Saratoga to complete carrier qualifications in the types.

In addition to the carrier qualification requirements, the squadron concentrated on the tactical development and the high altitude intercept capabilities of the Tiger. During 16-20 September 1957, F8U-1 and F11F-1 aircraft conducted intercept missions at medium to high altitudes against A3D Skywarriors from Heavy Attack Squadron Five (VAH-5) to evaluate these aircraft's capabilities in this mission. The F11F was also involved in air-to-air refueling tests conducted with AD Skyraider tanker aircraft. The F11F evaluation continued with high altitude gunnery tests during October 1957.

The Tiger evaluation program was completed in January 1958 and the F11F-1s were transferred to other commands. The testing of F4D-1s and F8U-1s continued until the squadron was decommisioned on 1 March 1960. VX-3 had a total of six F11F-1s assigned to it during this period.

Below, VX-3 family portrait on 10 May 1957. At that time squadron aircraft included the AD, TV-1, C-45, F4D-1, F8U-1 and the F11F-1 Tiger. (via Don Spering)

VX-3

Above, VX-3 F11F-1 138638 at NAS Atlantic City on 10 May 1957 with the squadron's original XC tail code. (USN via NMNA)

At left, VX-3 Tiger 138617 vents fuel prior to landing on 25 October 1957. Tail code had been changed to JC by that time. (via Don Spering)

Below, VX-3 F11F-1 138625 touches down on the USS Forrestal (CVA-59) in April 1958 during a two week deployment with F11Fs, F4Ds, and F8Us. (via Corky Meyer)

THE IRON TIGERS, FIGHTING ONE FIFTY SIX VA-156

VA-156 was originally commissioned at NAS Moffett Field, California, in 1956 as an Attack Squadron. The squadron was equipped with Grumman F9F-8 Cougars and was a special weapons squadron. In January 1957, the squadron was selected to introduce the Grumman F11F-1 Tiger to the fleet. Several pilots and a maintenance crew journeyed to Patuxent River, Maryland, and participated in the Fleet Indoctrination Program for the aircraft. In March, the Commanding Officer, CDR Jack L. Fruin, and two squadron pilots brought the first Tigers to the west coast.

Upon receipt of the new fighters, the squadron discarded their attack syllabus and commenced intensive training in fighter tactics. The pilots flew six and seven days a week to learn the characteristics of their new mounts. In October 1957, the squadron conducted gunnery training at NAAS Fallon. Twenty pilots flew a total of 605 hours in eight squadron Tigers. VA-156 was the first Fleet unit to deploy for gunnery exercises in the F11F-1, and many problems were encountered. The Fire Control System was fraught, with failure with only 3 or 4 out of the 8 systems working at any one time. Gun stoppages were also encountered, due primarily to cocked rounds. In the middle of the program, cams to prevent cocked rounds were installed on feeders of one airplane. Once installed, the problem was corrected on this test aircraft.

Above, VA-156 F11F-1 138638 under tow at NAS Moffett Field on 18 May 1957. Note the Tiger's rudder was gull grey instead of white. (W. T. Larkins)

The squadron learned its craft well and scored high on their Operational Readiness Inspection (ORI) aboard the USS Hancock (CAVA-19) in November 1957. The squadron deployed onboard the USS

Below, 138634 at NAS Miramar on 10 August 1957. Fin flashes and fin tip were painted red. (Larry Smalley)

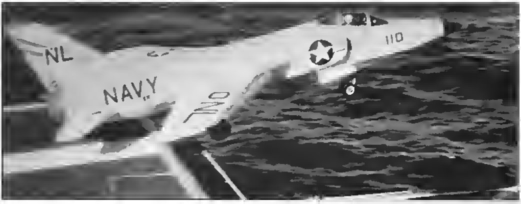
Shangri La (CVA-38) in 1958. During a weapons demonstration for Asian military leaders, VA-156 Tigers made impressive supersonic low level formation passes over the force. Once on station, the squadron sent four F11F-1s ashore along with two VF-114 F3H Demons to NAS Atsugi. These six aircraft became CVG-11's Det. Whiskey.

Above and at left, the first three VA-156 Tigers at Patuxent River, Maryland, with the pilots posing in preparation for their ferry flight to their home base of Moffett Field, California. 138638 #107 is in the foreground followed by 138635 #106 and 138634 #105. (National Archives)

After returning from their West Pac on 19 January 1959, VA-156 was redesignated VF-111. The red tail with white lightning bolt markings applied during the CVA-38 cruise were retained and VF-111 replaced VA-156 on the fuselage side. In March 1961, VF-111 converted to the F8U-2N at NAS Miramar.

Below, 138634 in flight in April 1957. (National Archives)

Above, prior to carrier deployment VA-156 converted to the long-nosed Tiger. 141731 is seen above. (via P. Bowers)
At right, VA-156 F11F-1 nose number 110 launches off the angled deck of the USS Hancock (CVA-19) during car-quals in November 1957. (National Archives)
Below, VA-156 F11F-1 nose number 111 is positioned on the port CAT while number 110 is raised from the forward elevator on CVA-19 in November 1957. (National Archives)



VA-156 USS SHANGRI-LA (CVA-38) DEPLOYMENT 3-58 THROUGH 10-58

Above, VA-156 Tiger 141738 is hoisted aboard CVA-38 for its Far East deployment. Note the nose gear is swiveled 180°. (via Gerry Markgraf)

At left, VA-156 F11F-1 launches from CVA-38. (USN)

Below, wing folded VA-156 F11F-1 141745 shares the deck with a VF-114 F3H Demon on the Shangri-La. The Iron Tigers repainted their aircraft for the cruise with distinctive red tails with a white lightning bolt on it. (via Gerry Markgraf)

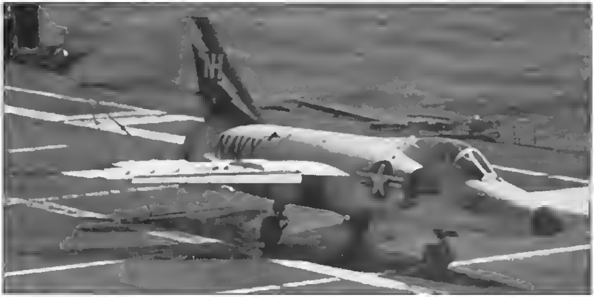
IRON TIGERS' CVA-38 DEPLOYMENT

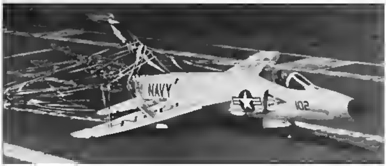
Above and at right, an Iron Tiger F11F-1 lands aboard the Shangri-La. Note the fully extended and lowered position of the tailhook. (USN)

At right, two VA-156 Tigers 141754 (101/NH) and 141758 (107/NH) over Mt. Fuji, Japan, in 1958. Note the last digit of the nose number is repeated in white on the lower rudder. (via SDAM)

Below, VA-156 Tiger crashes through the barrier after the right main gear failed. (via Leo Kohn)

At right bottom, carrier personnel inspect the forlorn Tiger. VA-156 Tigers were operated with inner wing hardpoints only (via Gerry Markgraf)





FIGHTER SQUADRON ONE ONE ONE, VF-111 SUNDOWNERS

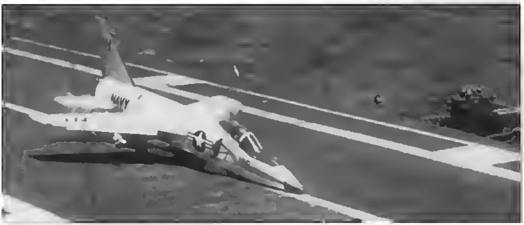
Above and below, VF-111 Tigers overfly the slopes of Mt. Fuji in Japan. (National Archives)

On 19 January 1959, the original VF-111 was decommissioned and the next day VA-156, the first PACAIR Tiger squadron, was redesignated VF-111. The squadron elected to replace its Iron Tigers nickname with the Sundowners nickname and heritage. This change was not in name only, as the squadron had a 100% turnover of pilots and enlisted personnel. An intensive three-and-a-half months of training prepared VF-111 for a deployment aboard the USS Shangri-La (CVA-38) from 6 March through 30 October 1959. All pilots were type trained by VF-121, the Pacific Fleet Replacement Air Group. In addition to carrier qualifying, all pilots were qualified in firing the Sidewinder air-to-air missiles.

VF-111 received an overall grade of "Excellent" during an administrative and material inspection conducted on May 1st and 2nd by COMFAIRPHILL. During this period, all pilots qualified in in-flight refueling from A4D-2 buddy tankers. Once on station, VF-111 conducted fighter sweeps of Okinawa in a test of USAF defenses during operation August Moon on 12 August 1959.

After returning to NAS Miramar, the squadron took part in operation "Cool Yule" on 10 November and on 7 December 1959. They were responsible for conducting ADIZ penetration in tests of the North American Air Defense System. They also took part in operation "Top Gun" Air Power Demonstration at the Naval Air Weapons Meet at MCAAS Yuma on 3 December 1959. On 17 and 22 January 1960, VF-111 conducted air augmentation defense exercises with the Los Angeles Air Defense Sector against shipboard launched attackers during Operation "Waffle Iron". In addition to four one-and-two-week carrier workup periods aboard the USS Hancock (CVA-19), the squadron conducted live Sidewinder firings at target rockets from 12 to 22 June 1960.

VF-111 USS HANCOCK DEPLOYMENT (CVA-19)



Above, VF-111 Tiger 141758 lands hard and loses its nose gear over the side while landing. Note Sidewinder missile loaded on the inner wing hard point. (SDAM)

The Sundowners departed NAS Alameda embarked on the USS Hancock on 16 July 1960 for Western Pacific Deployment. While in the Hawaiian Islands, the squadron received a mark of "Excellent" on its Operational Readiness Inspection (ORI). On September 3 through 5, operation "Square Knot", a joint 7th Fleet exercise, was conducted to measure the defense forces of Korea, Japan, Okinawa, Taiwan and the Philippines. Then, on 16 September, Operation Blue Sky was conducted to test the air defense forces of Taiwan. The squadron received another mark of "Excellent" during a SEATC officers weapons demonstrations.

Upon returning to Miramar, VF-111 became the first Navy squadron to transition into the F8U-2N (F-8D) Crusader. During its F11F-1 years, the Sundowners provided two pilots for the Blue Angels Flight Demonstration Team; LT C. P. Elliott in 1960 and LT R. E. Junkin in 1961.

At right and below, VF-111 Tigers 141802 and 141856 launch from the Hancock in 1960. (via G. Markgraf)

Above, VF-111 F11F-1 141856 on display at Kadena AFB, Okinawa, in 1960. (via Don Spering) Below, VF-111 Tigers 141820 and 141795 at NAS Miramar on 25 June 1960. Aircraft have red fin and wing tips and have mismatched nose cones. (William Swisher)

FIGHTER SQUADRON TWENTY ONE, VF-21 MACH BUSTERS

VF-21 was established as VF-74A on 1 May 1945, then redesignated VF-74 on 1 August 1945. The squadron was redesignated VF-1B on 15 November 1946. Then finally on 1 September 1948, the squadron was designated VF-21. VF-21 would be the second Navy squadron to receive the Tiger and the first Atlantic Fleet squadron to do so. VF-21 received its first Tigers in June 1957 and its last two on 11 October.

Home based at NAS Oceana VF-21 put its pilots through four months of intensive training, culminating with four weeks aboard the USS Ranger (CVA-61) on 12 November 1957. On 12 October, the squadron deployed to NAF Leeward Point, Guantanamo, for four weeks of air-to-air gunnery. The period ended after 657 hours of flight and the expenditure of 25,000 rounds of ammo. The gunnery record was dismal with about a 6% hit percentage. Like VA-156's first gunnery attempts, VF-21 was plagued with defective fire control systems and lack of parts to repair them.

VF-21 took thirteen Tigers aboard the USS Ranger on 12 November 1957 to take part in the final four weeks of her "shakedown cruise" in the Carribean. First to land aboard was LCDR James L. Holbrook, CO of VF-21. Second behind the Skipper was the CAG, CDR A. K. Earnest, CATG 181, who had joined the squadron to qualify in the F11F-1. During the remainder of the cruise, 16 pilots qualified, with 215 carrier landings, and flying 123 sorties for 141 total hours.

Above, one of the few short-nosed Tigers, BuNo 138633, received by VF-21. (USN) Below, VF-21 F11F-1 141812 is respotted on the Forrestal's deck in November 1957. (via Gerry Markgraf)

Upon returning to Oceana, the squadron entered another year of intensive training and became the RAG Replacement Training Squadron for East Coast F11F-1 pilots. The squadron was redesignated VA-43 on 1 July 1959 and provided replacement pilots for the F11F-1 and the A4D-1 Skyhawk. As VA-43, only eight F11F-1 pilots were trained before the Tigers were retired in 1960.

VF-21 USS RANGER DEPLOYMENT (CVA-61)

For the USS Ranger at-sea period, VF-21 carried ATG-181's AM tail code. At left top, plane captain sits in the cockpit of 141742 prior to spotting. (via G. Markgraf) At left middle, left and right views of VF-21 Tigers lined up on the deck edge. (via USN & G. Markgraf) At left bottom, 141744 is tensioned for launch in November 1957. (USNI) Above, 141757 prepares to launch after the launch of a sister ship in November 1957. (National Archives) At right, 141732 catches the number two wire on CVA-61 in November 1957. (MFR via S. Nicolaou) Below, deck handler with tailhook bar that was unique to the F11F-1 trots to the tailhook of 141745 in preparation of returning it to its fuselage receptacle. (National Archives)

Top, after returning to the beach, VF-21's tail code changed to AD for CVG-4/RCVG-4. 141765 in the foreground has a red windshield frame. (USN) At left, 141807 close up with black windshield frame and steps extended. (USN) Below, twelve VF-21 Tigers in echelon in 1958. (MFR) Bottom, 141740, 141745, 141765, and 141812 in flight. Note D has been freshly painted over ATG-181's M tail code. (MFR)

FIGHTER SQUADRON THIRTY - THREE, VF-33 ASTRONAUTS

VF-33 was first commissioned in 1943, flying F6F Helicats. The squadron was then decommissioned during the post-war demobilization, only to be re-established in October 1948 at NAS Ouonset Point, R.I., in the F8F Bearcat. The F8Fs were followed by F4U Corsairs, F9F Cougars and FJ-3 Furys.

Based at NAS Oceana, VA, the squadron received its first Tiger in November 1957 and had thirteen on hand by 31 December. Training at Oceana continued until 6 February 1958. The squadron took their Tigers to NAF Leeward Point, Guantanamo Bay, Cuba, for gunnery training until 8 March 1958. The trip was repeated from 22 June through 25 July. July 1958 was a busy month for VF-33, as they flew a total of 915.1 hours during their gunnery practice at "Gitmo" and their mirror landing practice at Oceana. These high flight hours were possible due to the excellence of VF-

Above, 141786 at Oceana in December 1957; squadron markings had not been applied yet. Note F11F-1 in the background has been painted in VF-33 markings. (Grumman)

Below, VF-33 Tiger 141817 taxis out in December 1957 at NAS Oceana. Lightning bolts were yellow with black outlines and the rudder was yellow with black stars. (MFR) Bottom, 141783 being towed at NAS New York on 3 July 1960, with 1959 Combat E above the National Insignia. (O'Dell via Roos)

33's maintenance department and the Tiger's low maintenance needs. The maintenance department was awarded a grade of 94.8 in the annual COMAIRLANT administrative and material inspection.

The Astronauts hit the boat for the first time in August 1958. This one week carrier qualification period was followed by four weeks of participation in LANTFLEX 2-58 aboard the USS Intrepid from 31 October through 25 November. The squadron was responsible for Combat Air Patrol and demonstrated strafing, Sidewinder attacks on KDA targets, in-flight refueling and sonic booms for the Armed Forces Staff College Demonstration on 25 November. VF-33 returned to CVA-11 from 14 through 23 January 1959 to conduct CAP during LANTFLEX 1-59.

CVG-6 and VF-33 deployed aboard the Intrepid from 13 February through 29 August 1959. During the cruise, the squadron took part in the following operations: Operation Big Deal, Operation Tune Up, Operation Top Weight, Operation Green Swing, Operation White Bait, Operation Chicken House, LANTFLEX 3, and LANTFLEX 3-59. The squadron performed so well during these exercises that it received the 1959 Combat Battle E for Atlantic Fleet day fighters.

A second Tiger deployment aboard Intrepid took place in 1960. This cruise ended on 17 February 1961, and the Tigers began to be replaced by Vought F8U-1E Crusaders on 1 March 1961. The transition progressed rapidly with the squadron deploying again on the Intrepid on 3 August 1961. The squadron would eventually transition to F-4 Phantom and finally the F-14 Tomcat.

Above, four VF-33 Tigers over Oceana in late 1957. Two aircraft have not yet been marked in squadron markings. (MFR via S. Nicolaou)

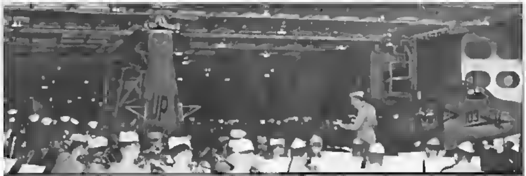
Below, VF-33 Tigers taxi forward for launch during carrier qualifications on CVA-11 on 27 October 1958. Another new Fleet aircraft, the Douglas A4D-1 (A-4A) Skyhawk, waits its turn. (USN)

Above, when VF-33 deployed the squadron's nickname, "Astronauts", was added to the fuselage side. At right, VF-33 Tiger taxis onto the cat. (USN) Below, VF-33 Tiger 141771 conducting touch-and-gos aboard the USS intrepid (CVA-11) on 15 November 1958. (USN)

Above, VF-33 Tigers are re-spotted after recovery aboard the USS Intrepid (CVA-11) on 27 February 1959 during Operation "Big Deal". Each aircraft has ita APU door open in the lower nose and their own tow bar. 141771 has a drain bucket positioned behind the tall skid under the tail. Below, with re-spotting completed, the recovery continued with AD-4W landing. (USN)

Above, two VA-65 AD-6 Skyraiders prepare for launch while VF-33 Tiger 141842 stands by in the starboard yoke on 18 November 1960. Note how the nose number is repeated as a 14 on the white wing flaps. The area under the flaps and slats is painted red. (USN) Below, with the Skyraiders gone, 141842 has pulled in the starboard catapult and 141815 is launching off the port catapult in afterburner while 141841 waits in the starboard yoke. All aircraft are armed with Sidewinder missiles. (USN)

Above, VF-51's first F11F-1 shares the runway with a VF-51 FJ-3. (via Kaston) Below, VF-51 F11F-1, nose # 103 on the hangar deck of CVA-20 in June 1958. (USN) Below middle, 141822 is off-loaded from CVA-20 in July 1958. (P. Hall via Tom Gates) Bottom, VF-51 pilots during carrier qualifications on CVA-61 in October 1958. CO was CDR Blattman. (USN via Kaston)



The second VF-51 was commissioned as VF-1 on 1 January 1943, then redesignated VF-5 on 15 July 1943 while flying F6F Hellcats. By February 1945, VF-5 was flying F4U Corsairs. Then, on 15 November 1946, VF-5 was redesignated VF-5A while flying the F8F-1 Bearcat. The Bearcat was replaced by the FJ-1 Fury on 18 November 1947, and VF-5A became the first Navy Fleet squadron to operate jets from carriers. On 16 August 1948, VF-5A became VF-51 with F9F-2 Panthers, which they flew along with F9F-5s during three Korean War deployments. In late 1953, F9F-6 Cougars replaced the Panthers, which in turn were replaced by FJ-3 Furies in 1955. These were replaced with Grumman F11F-1 Tigers in March 1958.

In June 1958, VF-51 deployed aboard the USS Bennington (CVA-20) during a cruise as the United States representatives to British Columbia's Centennial Fleet Week and Naval Review at Victoria. The ship then visited Everett, Washington, and upon return to NAS Alameda, the squadron was off-loaded and replaced with VF-111's FJ-3 Furies due to the Bennington's emergency deployment. The emergency was caused by the Ouemoy-Matsu incident. Because of this, the squadron traded-in their Tigers in January 1959 for F4D-1 Skyrays. Before retiring the Tigers, VF-51 would take them aboard the USS Ranger from 4 October to 10 October 1958 for carrier qualifications. This was followed by participation in Operation Barnstorm from 13 to 17 October 1958.

FIGHTER SQUADRON ONE TWO ONE, VF-121 PEACEMAKERS

Above, VF-121 Tiger 141777 in flight in it colorful red trim markings. Note the two sidewinder rails on each wing. (Grumman)

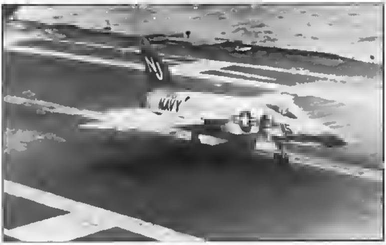
In 1958, under a reorganization plan for carrier aviation, VF-121 became the West Coast's permanent Replacement Air Group, charged with the mission of indoctrinating aviators and maintenance personnel into the fleet. In this role, VF-121 was equipped with the F11F-1 Tiger, F3H-2 Demon, F2H-3/4 Banshee and the F3D-2 SkyKnight. By 1965, the squadron was equipped only with F-4 Phantoms, which it flew until it was decommissioned in 1980.

VF-121 originally stood up as reserve squadron VF-781 at NAS Los Alamitos on 1 July 1946, flying the F6F Hellcat. The F4U Corsair came next, followed by both F9F Panthers and Cougars. The FJ-3 Fury came next, followed by the F11F-1 Tiger in January 1958. When VF-121 became the RAG in April, it merged with VF-124 and absorbed its Demons. The SkyKnights and Banshees were added to the squadron to provide alternate radar training aircraft for the Demon inductees.

VF-121's Tigers retained their colorful red markings until early 1959. In these colorful regalia, the Peacemakers conducted carrier qualifications on the USS Lexington on 14 and 15 July 1958, followed by six days aboard the USS Bon Homme Richard starting on 25 August. Another twelve days were spent aboard the USS Ranger from 6 to 17 October 1958. This was followed by a dependent's cruise out of San Diego from 23 January to 5 February 1959 aboard Lexington. A two-week USS Oriskany cruise took place on 27 July 1959, and again for a week starting on 8 September 1959. After this cruise, the Tigers were retired from VF-121.

During this period, the squadron received a dispatch for outstanding performance during CARQUALS aboard the Bon Homme Richard from the carrier's CQ, followed by a letter of commendation from CVG-12 concerning same said CAROUALS. Another letter of commendation was received from CVG-12 following CAROUALS on Ranger, and a third commendation letter was received for carrier operations aboard Lexington in January and February 1959.

Below, VF-121 Tigers 141777 (101), 141796 (111), 141801 (110) and 141795 (109) in flight (via AHHS)



Above, VF-121 Tiger 141857 on final over the fan tail and at left as it runs the cable out after landing. (via Leo Kohn) Below, VF-121 Tiger nose number 111 sheds both nose wheels after landing. One wheel can be seen going over the side, while the other one bounces down the deck along the centerline. (via SDAM)

At right top, VF-121 F11F-1, 141777, nose number 121 parked on the ramp at NAS Point Mugu, California, in June 1959. The colorful red markings have been removed and a stylized italic VF-121 has been painted on the fuselage. (USN via Kaston) At right bottom, good view of subdued markings and stylized VF-121 on 141785 at the NAS Point Mugu open house on 16 May 1959. (William Swisher)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FIGHTER SQUADRON ONE NINE ONE, VF-191 SATAN'S KITTENS

Above, VF-191 Tiger 141772 at NAS Moffett Field open house on 17 May 1958. The original colorful tail markings were a red diamond bordered by white with a black NM bordered by white on the diamond. (D. Olson via Swisher)

VF-191 was established as VF-19 at NAAS Los Alamitos, CA, on 15 August 1943. Originally equipped with F6F-3 Hellcats, it became the first Navy squadron to equip with F8F-1 Bearcats in February 1945. On 15 November 1946, VF-19 was redesignated VF-19A, and then on 24 August 1948, Satan Kittens became VF-191. In 1949, the squadron transitioned to Grumman F9F-2B Panthers. These were replaced with F9F-6 Cougars in 1953 and FJ-3 Furys in 1955.

While assigned to NAS Moffett Field, CA, the "Kittens" received their first supersonic mount, the F11F-1 Tiger, late 1957. The first Tiger arrived on 4 October 1957, and the last departed in July 1960 in favor of Vought's F8U-1 Crusader.

CDR R. N. Glasgow was CO when the F11F-1s were acquired. CDR Glasgow claimed a notable first for the squadron and the US Navy by taking the squadron's mascot "Tiger Tom" on a supersonic flight in the F11F-1, thus becoming the first supersonic cat. Training at Moffett continued until 1 April 1958, when the squadron deployed to NAAS Fallon, NV, for two weeks of gunnery practice. This was followed by a second two weeks from 18 May to 29 May 1958. Carrier qualifications were conducted on the USS Bon Homme Richard (CVA-31) from 13 to 27 June, 21 July to 7 August, 19 to 23 August, 28 to 30 September, and from 5 to 18 October 1958.

During 1958, the squadron flew tracking exercises for the US Army Nike sites in the San Francisco area during February. They also provided display aircraft for Armed Forces Day displays at Salt Lake City, Fallon, Oakland, Alameda and NAS Moffett Field. They also participated in an air show at the groundbreaking ceremonies at the future NAS Lemoore.

Below, VF-191 F11F-1 141785 on 17 May 1958 at NAS Moffett Field. (Larry Smalley via Swisher)

Above, three VF-191 Tigers firing up at NAS Moffett Field in 1957. (USN)

VF-191 participated in operation Blue Bolt from 9 to 11 July and the air shows at Reno, Oakland, Portland, and Whidbey Island. To top the year off, the squadron received a Letter of Commendation for Accident Free Flying during Fiscal 1958, and the COMNAVAIRPAC Battle Readiness Excellence Pennant for the period September 1957 to December 1958.

The squadron deployed its Tigers aboard the "Bonnie Dick" from 31 October 1958 through 18 June 1959.

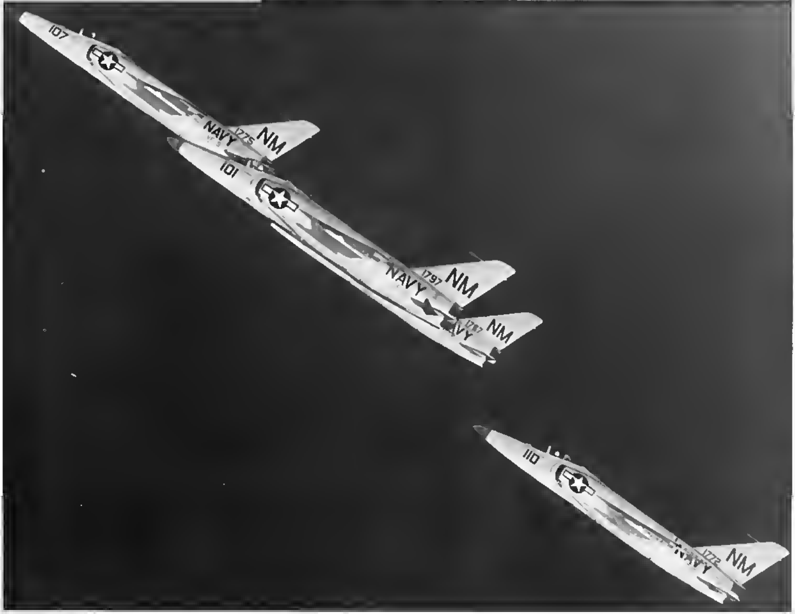
In November 1958, the squadron became the first F11F-1 unit to night qualify division pilots in carrier operations. On 7 February and 19 March 1959, VF-191 flew CAP hops and fighter sweeps in a simulated attack on Taiwan during operation Blue Sky. Further CAP flights were flown from 24 to 26 March during Operation Strike X against Japan, Okinawa and the Philippine Islands. A simulated conventional and atomic war exercise called Granite Creek was conducted from 25 to 29 May 1959.

After returning to Moffett, the Air Group completed a quick turnaround and re-deployed aboard CVA-31 from 28 August to 30 September and again from 20 November 1959 through April 1960.

Below, squadron line at Moffett with 141773 in the foreground followed by 141762 then 141785 in early 1958. (R. A. Carslile via NMNA)

VF-191 USS BON HOMME RICHARD DEPLOYMENT (CVA-31)

At left top, 141790 starts down the catapult on CVA-31. (USN) At left middle, 141764 and 141810 fly past the plane guard with hooks down. (MFR) At left bottom, 141775 is positioned on the port cat and 141772 is waiting in the port yoke. (USN) Above, 141802 with practice Sidewinder and battle E at NAS Oakland on 9-6-59. (Smalley) At right, 141775 wave-hopping off CVA-31. (USN) Below, formation of four VF-191 F11F-1s. (Grumman)



FIGHTER SQUADRON TWO ONE ONE, VF-211 HUNTERS

Above and below, VF-211 Tigers 141859 and 141880 over Japan in 1959. Markings on VF-211 F11F-1s were very austere with just red wing and fin tips. (USN)

VF-211 was originally commissioned on 1 May 1945 as Bombing Squadron Seventy-Four (VB-74) at NAAF Otis Field, ME, flying Curtiss Helldivers. On 15 November 1946, VB-74 was redesignated VA-1B. The Helldivers were replaced with AD-1 Skyraiders in July 1947. On 1 September 1948, VA-1B was redesignated VA-24 and the AD-1 were replaced by the AD-2 in December, and then the F4U-4 Corsair in February 1949. On 1 December 1949, the squadron was redesignated VF-24. A Korean War cruise aboard Boxer (CVA-21) in F9F-2 Panthers was concluded in September 1952. The squadron upgraded to Grumman F9F-6 Cougars and then FJ-3/3M Furys in 1955. The highly maneuverable Furys were phased out in the summer of 1957 for the all-weather F3H-2M Demon. Then, during Christmas week of 1958, the Demons were replaced by Grumman F11F-1 Tigers and the squadron was relocated to NAS Moffett Field, CA. On 9 March 1959, VF-24 switched squadron designations with VF-211, becoming VF-211 Hunters. The squadron's association with the Crusader started in December 1959 when the F11F-1s were replaced by F8U-1s. The squadron, now known as the Checkmates, would fly various models of the Crusader for the next sixteen years and become famous as the "MiG Killers" in Vietnam.

Even though the Hunters, in the guise of VF-24, originally received

At right, VF-211 Tiger 141850 tensioned for launch on CVA-16. (USN) At right middle, F11F-1 141854 leaves the deck at the end of the catapult stroke. (USN) At right bottom, three VF-211 Tigers prepare to launch from the USS Lexington in 1959. (USN)

their first Tigers in December 1958, no photos have ever come to light showing F11F-1s in VF-24 markings. Prior to the redesignation to VF-211 on 9 March 1959, a gunnery deployment was made to NAAS Fallon, NV, from 30 January and 19 February. The squadron left Fallon with the highest gunnery percentage to date racked up by any F11-1F squadron. This was followed by carrier qualifications aboard the USS Lexington (CVA-16) from 15 to 20 March 1959. Then, as VF-211, the Hunters made a second carrier qualification on Lexington from 6 to 18 April. After this successful at-sea period, the squadron deployed in earnest on 25 April. The Lexington deployment lasted until 30 November 1959.

During the deployment, VF-211 participated in Operation Blue Sky on 13 July 1959. VF-211 launched numerous simulated strikes against targets in Taiwan to test the air defense capabilities of the Chinese Nationalist Forces. On 18 July, similar simulated strikes were launched against targets on Okinawa. The 68th Fighter Interceptor Squadron's defense capabilities were tested during strikes against Itazuke AFB on 24 August . On 26 to 31 August , Operation Tall Dog was conducted which tested the defense of the CVA Task Group.

During the cruise, LT R. H. Foster made the first successful F11F-1 carrier launch as a tow aircraft with an air-to-air banner on 1 July 1959. On 1 August, LT S. T. Clinton made the 23,000th landing aboard Lexington since recommissioning in 1955. Then, on 9 September 1959, LT Clinton also made the 24,000th landing. During the deployment, squadron pilots flew 2,068 hours and completed 1,264 carrier landings, an impressive record for a new aircraft.

VF-211 USS LEXINGTON (CVA-16) DEPLOYMENT 1959

Above, "pilots man your aircraft!" VF-211 pilot approaches F11F-1 141825. (USN) Below, nose of F11F-1 141825 (105/NP) covers BuNo of the only Tiger with checkered tail markings, presumably the CAG bird or CO's aircraft. (USN) Bottom, VF-211 Tiger 141849 tail hook is released by the arresting gear crewman on the USS Lexington (CVA-16) on 12 May 1959. (USN)

Above, VF-211 aircraft serve as the backdrop for a personnel inspection. (USN) Below, VF-211's Tigers fill the hanger deck of CVA-16 in 1959. The F11F-1's wings made for much cooler sleeping quarters. (USN)

ADVANCED TRAINING UNIT TWO TWO TWO, ATU-222 GRIFFINS

ATU-222 was established on 19 November 1958 at NAS Kingsville, Texas, under the command of CDR Vince Kelly. It was the first unit in the Naval Air Training Command to employ supersonic aircraft. The squadron was formed to provide advanced jet training for future Navy and Marine pilots.

The training syllabus consisted of: advanced air-to-air and air-to-ground gunnery, swept-wing jet familiarization, all-weather instrument flight, tactics and formation flying in the F11F-1 Tiger. The first three students completed the syllabus and received their wings in March 1959. By the end of 1959, forty-three students were graduated and a total of 6,060 flight hours were amassed. There were no accidents that year and ATU-222 was awarded the Chief of Naval Operations (CNO) Safety Award for 1959. In May 1960, ATU-222 was redesignated Training Squadron Twenty-Three, VT-23.

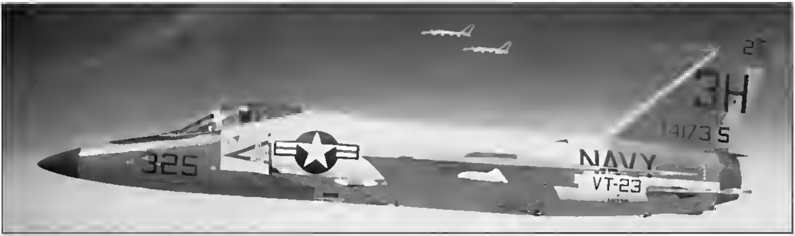
TRAINING SQUADRON TWENTY - THREE, VT-23 GRIFFINS

At left top, student completes first F11F-1 flight. Markings are identical to ATU-203 on page 120 except for the tail code. (USN) At left bottom, ATU-222 F11F-1 141753 in front of NAAS Kingsville Operation building In 1959. (via Corky Meyer)

ATU-222 and VT-23 squadron insignia "The Griffin" was designed during a contest hosted by ATU-222's second CO, CDR William Coulter. The "Griffin" was described as a phantom of Greek mythology, with the head and forefeet of an eagle and the body, hind legs, and tail of a lion. The union of these two creatures symbolized strength and vigilance.

VT-23 came into existence in May 1960 when ATU-222 was redesignated VT-23. During fiscal 1960, the squadron racked up 10,163 accident free flight hours and was awarded its second consecutive CNO safety award. Although the squadron's mission remained the same, its training syllabus was shortened to allow more promising students the opportunity to undergo and benefit from advanced training in supersonic aircraft. With the shortened program, the squadron completed 182 students, four times its previous annual figure. The squadron graduated its last F-11A Tiger student in June 1965, after transistioning to Grumman TF-9J Cougars earlier in the year. The Cougars were replaced with TA-4J Skyhawks in April 1970.

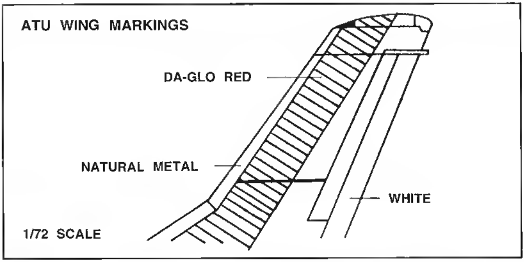
Top and bottom, da-glo red nose, tail and forward wing sections characterized VT-23 F11F-1s In 1961. (Sinwell) Above, da-glo red area had been reduced by 1963 as seen on F11A 141792. (via Nicolaou) Below, very tired 141785 in 1965. (via Kaston)



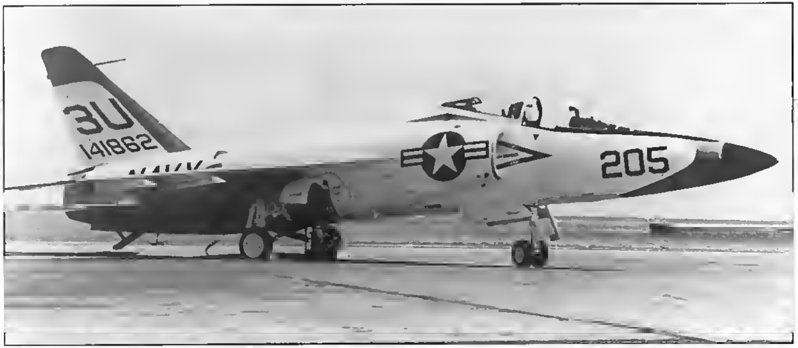
ADVANCED TRAINING UNIT TWO ZERO THREE, ATU-203

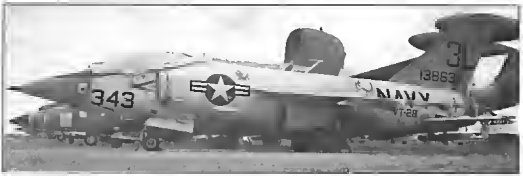
The Navy's first all-jet training base was NAAS Chase Field, Beeville, TX, home for F9F-8 Advanced Training Squadons ATU-203 and ATU-213 in early 1959. By the end of 1959, ATU-203 had followed in NAAS Kingsville ATU-222 footsteps by equipping with the supersonic F11F-1 Tiger for advanced training and Sidewinder missile familiarization. In June 1960, Advanced Training Unit 203 was redesignated Training Squadron Twenty-Six, VT-26.

Above, Advanced Training Unit Two Zero Three, ATU-203, line in late 1959. White and da-glo red Grumman F9F-8T with 3U tail code is in the foreground. Fully marked white and da-glo red F11F-1 141863 (nose number 203) is flanked by both the Cougar and a newly arrived and unmarked F11F-1 Tiger. (via S. Nicolau)



Below, ATU-203 F11F-1 Tiger 141862 at NAAS Chase Field, TX. Aircraft is overall white with da-glo red nose, tail, lower rear fuselage and forward wing halves. (USN)





Above, this rare short-nosed Tiger, BuNo 138636, was assigned for a short time to VT-26, seen here in storage at NAF Litchfield Park on 3-23-64 with the squadron insignia on the fuselage just above the wing root. (William Swisher)

In June 1960, VT-26 was formed by the redesignation of ATU-203 to Training Squadron Twenty-Six. Stationed at NAAS Chase Field, TX, VT-26 was charged with the missions of conducting advanced jet training in familiarization and high altitude tactics and weaponry, and in augmenting the Continental Air Defense Forces. An ancillary duty for the squadron was to familiarize new members of the Blue Angels Flight Demonstration Team. The only other F-11A Tiger unit after VT-23 retired its Tigers in June 1965. TF-9J aircraft started replacing the Tigers in March 1967, with the final F-11A student, ENS M. E. Taylor, completing the program on 26 June 1967.

In 1966, the Tiger was showing its age. The F-11As in service with VT-26 had surpassed their original service life expectancy. Equipment failures and shortage of spares had increased maintenance hours to 20

Below, VT-26 line at NAAS Chase Field in 1963. Front to back: 141864 (303/3L), 141840 (313/3L), 141729 (326/3L), 141812 (332/3L), and 141814 (316/3L). (Grumman via S. Nicolaou)

per each flight hour in 1965 and had reached 30 hours per flight hour in 1966. Additionally, a series of incidents and airframe failures occurred in 1966. The first incident occurred on 3 March, when LTJG J. M. Williams, a student aviator, received moderate back injuries when he ejected from his uncontrollable F-11A. His Tiger had lost all flight control hydraulic pressure because of an afterburner fuel leak fire. His back injuries were the result of ejecting from a spin.

On 20 July, an F-11A piloted by squadron instructor, LT Thomas W. Hogan, shed both of its wings in flight. On separating from the aircraft, the starboard wing struck the port wing causing it to fail at the wing root. Grumman's investigation determined that the wing strength member in the starboard wing had been cracked during original assembly and that the crack progressed by fatigue to catastrophic failure. It was further determined that the service life of the F-11A was in the neighborhood of 3,000 flight hours, but could be increased to 3,600 hours with the addition of doublers in the wings of the aircraft. After this finding, all aircraft were rotated through O&R MCAS Cherry Point, NC, for installation of doublers on the wings. To further complicate the problem, the retirement of the Tigers, which was scheduled for 1966, was extended to the end of fiscal 1967 due to shortage of TF-9J replacement aircraft. To accomplish this, eleven

Above, VT-26 Tiger 141843 at NAS Glenview, IL, on 18 May 1963. The aircraft still carried the F11F-1 designation, which had been changed to F-11A in 1962. (Paul Stevens via D. Spering)

Below, 141839 at NAS Point Mugu, CA, on 10 November 1963. VT-23's nose numbers had changed to 6XX series from its previous 3XX series. (William Swisher)

Tigers were removed from storage. Of the eleven, seven were put into immediate operating status, one was stricken, one was sent to Cherry Point for deep inspection, and three were put in reserve pending inspection.

At the start of 1967, the squadron had 52 Tigers assigned. As the F-11A program wound down, Tigers were ferried to storage at Litchfield Park by graduating students accompanied by instructors as there were no F-11A qualified ferry pilots in either ferry squadron. In total, 49 Tigers were ferried to Litchfield and 4 were scrapped at Chase. Some of the F-11As were initially grounded at Chase, and a maintenance crew was dispatched to Litchfield to salvage parts to make the remaining Tigers flyable for their final ferry flight.

Prior to retirement, three additional incidents occurred. On 27 January, instructor pilot CAPT R. F. Thomson, USMC, sustained minor injuries when he ejected from his F-11A during climbout from Chase Field. He was on a gunnery banner tow mission, and at about 6,000 to 8,000 foot altitude he experienced a hydraulic failure followed by loss of control and subsequent engine fire. On 31 March 1967, CAPT C. J. Clanton, USMC, a VT-26 student, suffered fatal injuries when he ejected from his F-11A aircraft in the landing pattern. Cause of the accident was not determined. On 15 April, CAPT R. S. Morris, USMC, escaped injury when he ejected from his Tiger following an engine failure.

During 1966/67, VT-26 famed (familiarized) six Blue Angel pilots in the F-11A. They were: LT Norman Gandia in January 1966, LCDR Billy Wheat, Blue Angels CO, LT Frank Gallagher, and LT John Allen on 29 December 1966, CAPT R. F. Thomson, USMC, on 15 February 1967, and CAPT Vince Donile, USMC, on 3 March 1967. The squadron further supported the "Blues" by providing loaner aircraft from November 1966 through March 1967, while four of the Blue Angel Tigers were in rework.

Above, VT-26 Tiger 141829 at NAAS Chase Field in 1967. The aircraft is surrounded by its replacements, TF-9J Cougars. (Ron Picciani)

Below, VT-26 Tiger 141824, on bailment to the Blue Angels, taxis out with Blue Angel number five for a training flight at NAF El Centro, CA, on 11 March 1967. Notice takeoff position of the slats and flaps. (William Swisher)

At right, the first Tigers conduct a formation roll over Pensacola Beach, FL, in 1957 with CDR Ed Holly in the lead. The white streaks coming from the wing tank dumps were made by water. (USN)

The Blue Angels Flight Demonstration Team was formed in 1946 with the Grumman F6F Hellcat to assist Naval recruitment of pilots after the end of World War Two. The "Blues" had a succession of aircraft in the primary and secondary flight role prior to receiving the F11F-1 Tigers in 1957. These were: F6F Hellcats, F8F Bearcats, F9F Panthers, TV-2 T-birds, F9F Cougars, SNJ Texans, and F7U Cutlasses. The "Blues" flew first contract and then second contract Tigers until 1969, which is the longest any one Navy fighter has been flown by the Angels to date. During the Tiger years, forty different F11F-1/F-11As were assigned to the team. These were: BuNo 138633, 639-645, 647, 141738, 764-765, 775, 777, 790, 797, 802, 811-812, 816, 823, 829, 831, 837, 847, 849-851, 853, 859, 863, 867-868, 872-874, 876, and 882-884.

CAPT Ed Holly, leader of the Blue Angels in 1957 who selected the Tiger over several other competitive aircraft, shared these comments with Corky Meyer:

"Flight control response was outstanding for rolls and high G operations in the four-plane diamond for-

Below, the original first contract short-nosed Tigers in the first of many paint schemes with Ed Holly in the #1 machine. (via Corky Meyer)

Above, in 1958 the Blues changed their paint scheme as seen in this in flight formation photo. (AAHS via Kaston) At right, short-nosed Blue Angel "6" in 1958. Intake lip was chrome and markings were chrome yellow. (via Burger)

mation. In addition, the landing approach speed was just right for four-plane diamond landing. Afterburner was a welcome addition for show operation. It was a great crowd pleaser and provided the ability to gain altitude quickly and at the same time keep the show closer to the crowd. A very important feature was the strength designed into the airframe. This made it possible to pull 8 to 9 G on vertical maneuvers."

LCDR Scotty Ross, who was Maintenance Officer and C-54 pilot for the Angels for three years in the 1960s, related:

"The engine had excellent reliability, and the inlet ducts of the Tiger were high enough that we only had two cases of Foreign Object Damage (FOD,) and the fact the Tiger was in the training command meant that we always had a source for aircraft availability year-round."

CDR Bob Aumack was the Team Leader when they performed at the Paris Air Show in 1965 for the first time. Corky Meyer was witness to the first time the French ever gave a

Below, the Angels' six short-nosed Tigers at NAF Litchfield Park in 1958 with their support R5D. (Bob Carlisle via NMNA)

standing ovation to a demonstration team in the history of that show. The finale to the show was the impressive six-plane take-off and landing, which was unique to the Tigers.

CDR Aumack relates: "Cockpit visibility over the nose and to the side was great and was needed by the leader at all times. Blue Angel maintenance was absolutely superb, and 100% availability was the norm. Once I strapped it on and fired it up, it was easy to fly away with it clinging onto my skinny butt. I found it to be a typical Grumman fighter: easy to handle, positive and honest in its flight characteristics, and once the nose was pointed downward, it headed towards mother earth in a hurry."

Action photos both pages U. S. Navy.

Below, four-aircraft formation take-off at Nellis AFB on 14 November 1966. (Bob Lawson via NMNA)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BLUE ANGELS FLIGHT DEMONSTRATION TEAM

At left top, Blue Angels one through four pass the Statue Of Liberty In 1964. (USN)

At left bottom, Blue Angels one through four fly past Mount Rushmore in a classic publicity photo. (USN)

Above, solo aircraft five and six perform maneavers with smoke on. (Ron Piccianni)

At right, four aircraft bank away from the camera in formation. (USN)

Below, Blue Angel number one flys wing with Grumman's copper colored corporate Bearcat N7700C (Grumman via Craig Kaston)

Above, 141884 #5 and 141883 #6 at NAS Miramar on 4-8-62. (Swisher) Below, 1961 squadron lineup: #1 141872 CDR Zeb Knott, #2 141868 CAPT Doug McCaughey, #3 141883 LT Bill Rennie, #4 141869 LCDR Ken Wallace, #5 LT Lew Chatman and #6 LT Dan Macintyre. (via Leo Kohn) Bottom, at NAS Pensacola, FL, in June 1968. (Don Priest)

At right top, CAPT Fred Craig 1966. (Cuddy) Blue Angel Gate Guards: #5 at Quantico, VA. (via Burger) #4B at NAS Glynco in 9-70. (AAHS) #1 at NAS Pensacola 1980.(via Kaston) #4 at NAS Lakehurst on 7-24-76. (Ostrowski) #7X at NAS New Orleans in 1986. (via Burger) #1 at unknown location in 10-89. (via Kaston) Bottom, CDR Wm. Wheat on 9-14-68. (Roos)


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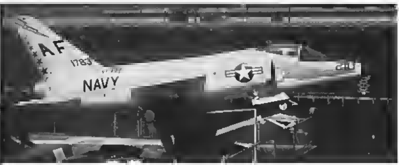
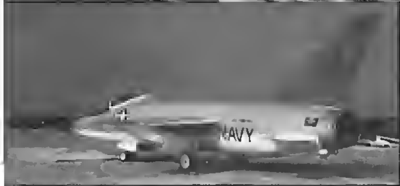
Blue Angels

GATE GUARDS AND DISPLAY AIRCRAFT



Above left, NAS New York short-nosed F11F in the 1970s, BuNo unknown. Above, what's believed to be the same F11F onboard the Intrepid museum in the markings of VF-33 long-nose 141783. (via Kaston) At left, gate guard at El Centro in 1977. In the 80s the F11F was painted as a Blue Angel, BuNo unknown. (Begley) At left, 646/3L onboard Yorktown. (via Kaston) At left below, 141828 in storage at Pensacola in 1970. (Ginter) Bottom, 141828 after repainting at Pensacola in 1974. (via Markgraf) Below, 141796 at Pima in 1976. (Ginter) Below, NAS Jacksonville Tiger. (L. B. Sides)



THE TIGER THAT ROHRED, THE ROHR IN-FLIGHT THRUST REVERSER

After retirement, the Navy refurbished two Tigers for use in evaluating the potential advantages of an in-flight thrust reverser on a tactical aircraft. F-11A, BuNo. 141853, was modified into the flying testbed. A second F-11A, BuNo. 141824, was used in the conceptual development program for baseline data, pilot familiarization training and as a chase aircraft.

Flying qualities, performance, engine effects, durability, and utility of the device to accomplish mission tasks such as air combat maneuvering, air-to-ground weapons delivery, approach and waveoff, landing rollout and infrared signature suppression were evaluated during the initial six month program. The prototype device increased the tactical effectiveness of the F-11A airplane despite the limited capability of the testbed. Testing indicated potential increases in tactical capabilities of future fighter/attack aircraft which incorporate in-flight thrust reversers. Specifically, mission effectiveness of the F-11A was significantly enhanced in the area of air combat maneuvering, landing rollout distances, air-to-ground ordnance delivery, and precise handling qualities as in formation flying.

Although the testing showed promise, there were a number of deficiencies noted and it was recommended that an improved prototype in-flight thrust reverser be installed on a modern Navy fighter aircraft such as the F-14A.

One problem encountered was that the magnitude of the pitching moment excursion experienced at blockages (thrust diversions) of 62% to 100% resulted in unacceptable approach and stall characteristics. Another problem was the extent of the pitching moment changes during waveoffs from blockages greater than 75%. Another ten deficiencies were recorded and were to be corrected in a new prototype design.

Above, F-11A 141853 after refurbishing at Grumman and prior to the installation of the Rhor in-flight thrust reverser. The aircraft was painted white with red trim and had a black canopy and anti-glare panel. The thin stripes inboard of the red wing and tail stripes were black. The wing root area was polished metal. (Grumman) Below, 141853 with the in-flight reverser installed in August 1974. (Picciani) Below middle, 141853 in January 1975, the thin intake stripe is black. (Ben Knowles) Bottom, 141853 on display at the Pima County Air Museum in November 1978. (Craig Kaston)

Above left, left side view of the in-flight thrust reverser. The Grumman logo, the words THRUST CONTROL and the NATC logo were in medium blue, the word INFLIGHT was in red. The number 1 and the stripe above it were black, the fin tip was red. (Kaston) Above, the right side of the vertical stabilizer had a black stylized "S" for Service Test at NATC. (Kaston) At left, 141853 as it appeared at Pueblo, Colorado, in 1992, painted in bogus VF-211 markings. (via Kaston) Below, F-11A 141853 with the in-flight thrust reverser installed flies with the training and chase aircraft, F-11A 141824. (Grumman)

Above, the in-flight thrust reverser chase aircraft. F11-A 141824 in temporary storage at Davis-Monthan AFB on 14 March 1975. Note the stylized black "S" on the tail and the medium blue Grumman logo on the intake lip. (Leader via Kaston) At right, 141824 after being refinished into authentic Blue Angel markings at the Pima Air Museum in December 1992. (Pima Air and Space Museum via Kristen Todesco)

1/100 SCALE PLASTIC TIGERS FROM MONOGRAM

In the late 1950s Monogram released a four aircraft flight display model kit of the Blue Angels aircraft one through four in a diamond formation on a display stand. These aircraft actually measure close to 1/102 and are the rarest Tiger kit.

1/48 SCALE PLASTIC TIGER FROM PAUL LINDBERG

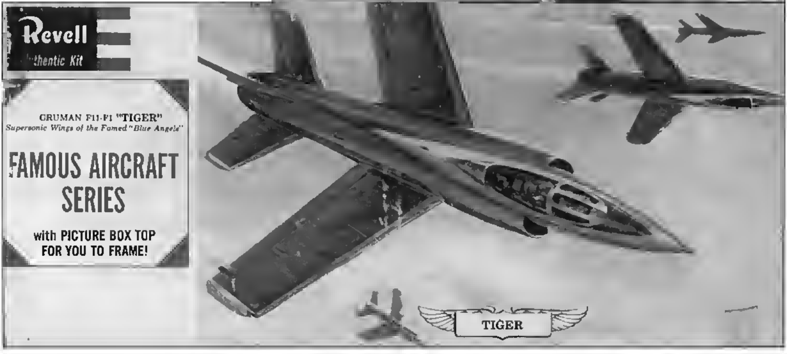
The Lindberg kit was first released in the 1950s and was molded in 1/48 scale. Like most of Lindberg kits in the '50s, the Tiger is modeled after the prototype, and as such is representative of the F9F-9. Comparing the kit with photos of the prototype show that the kit is fairly accurate. The kit features optional position landing gear, movable flaps, movable rudder, movable all-flying horizontal tail, optional position speed brake and opening panel on top of the fuselage for viewing the engine. The kit also features eight unguided missiles, which were never fitted on the Tiger. The model below was built stock from the box in the early '60s without any putty or modification.

In 1957, Lindberg reissued the kit as a short-nosed Blue Angel Tiger with decals for ships one through six. The Blue Angel Kit was released again in 1982 with new box art. The kit surfaced again in 1990 as a VA-156 short-nosed Tiger, as one of Lindberg's Classic Replica Series.

1/54 SCALE PLASTIC TIGERS FROM REVELL

The Revell kit was molded in 1/54th scale and was originally released in 1956. It was reissued in 1960 as a short-nosed Blue Angels Tiger. Both box tops were a classic example of the advertisers craft.

The model featured here was made stock from the box from the 1960 kit. The kit possess little accuracy, and is one of Revell's worst kits from that era. The kit features a very crude refueling nose and poor decals with optional position wing tips, optional position landing gear and tail skid. A typical '50s one piece pilot figure was also included.

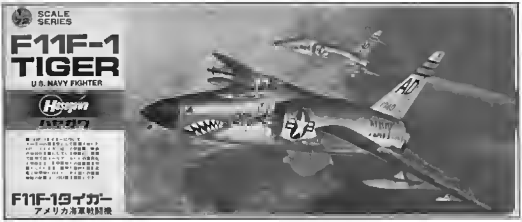


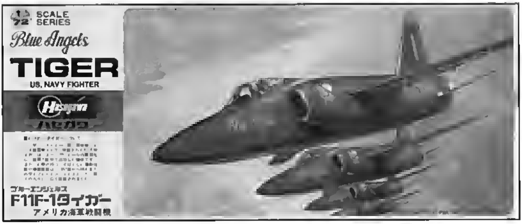
1/72 SCALE PLASTIC TIGERS FROM HASEGAWA/MINICRAFT

Hasegawa first released it's Tiger model in 1980 as a Blue Angels kit and molded in blue plastic. The second kit depicted a Tiger of VF-21. This kit was molded in grey plastic with decals for VF-21 and VT-26. In America the kit was marketed by Minicraft in grey plastic with decals for VF-21 and the Blue Angels. In the '90s the Tiger was reissued as a Blue Angels kit using the same box art that was used in 1980. The Tiger kit is currently available as a VF-33 aircraft with decals for a VF-21 aircraft. The Hasegawa kits have 44 parts with crisp panel lines and flash free moldings. Hasegawa erred in the kit and on the box tops by including the Grumman area-ruled drop tanks which were never used operationally. Optional position canopy and tailhook are provided as well as Sidewinder missiles. Overall, the Hasegawa Tiger is an excellent kit.

Tiger decals were produced by Scale Master and Microscale. Scale Master sheet #SM-19 was for VF-33 Astronauts. Scale Master sheet #SM-22 had decals for VF-121, VF-191, and VA-156. Microscale sheet #72-255 had decals for VA-156, VF-51, VF-121 and VF-33.

The kits depicted here were all built in 1980-81 with kit decals and those from Scale Master. The VT-23 Tiger was the first kit built with decals coming from the spare parts box. It shows how easy it is to detail the kit by cutting the wing tips and flaps and repositioning them. A refueling probe was also added by using parts from a RA-5C kit.






2
U.S.NAVY


AD
1740
205
NAVY


AF
206
NAVY


NJ
115
NAVY


NH
103
NAVY


1785
105
NAVY


NAVY
VT-26
33

1/48 SCALE RESIN AND METAL COLLECT-AIRE TIGER

Collect-Aire Models makes a fine series of 1/48 scale resin kits with metal and photo-etched parts and decals. All kits are limited and are for the serious collector so be prepared for sticker shock. For more information about this model, or the extensive product line of Navy aircraft offered, write Collect-Aire Models, 166 Granville Lane, North Andover, MA 01845. Phone (508) 688-7283, FAX (508) 685-0220. (photo courtesy Collect-Aire Models)

Below left, Grumman's original factory display model seen here with bogus decals for a VF-51 aircraft.

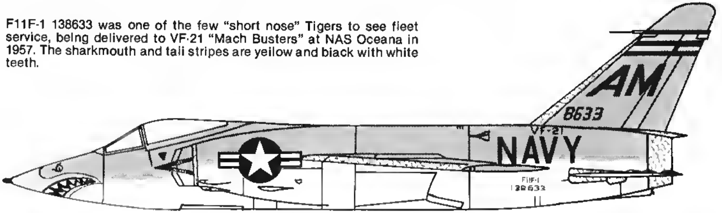
Below right, Philippine-made mahogany desk model with bogus decals for VF-194, a sister squadron of VF-191 which never operated the F11F Tiger.

DISPLAY MODELS

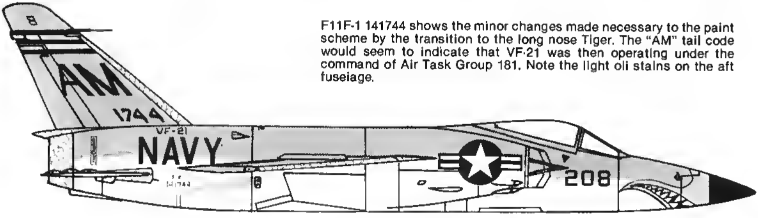
FLEET TIGERS

ILLUSTRATIONS BY CRAIG KASTON

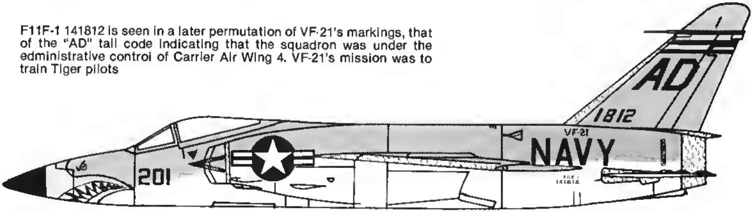
F11F-1 138633 was one of the few "short nose" Tigers to see fleet service, being delivered to VF-21 "Mach Busters" at NAS Oceana in 1957. The sharkmouth and tail stripes are yellow and black with white teeth.



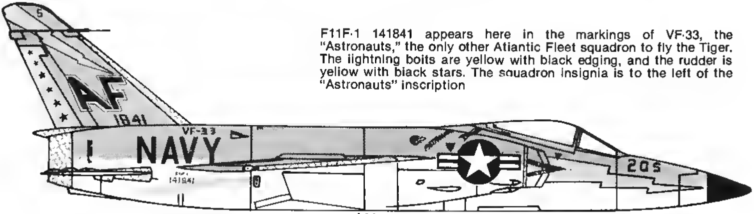
F11F-1 141744 shows the minor changes made necessary to the paint scheme by the transition to the long nose Tiger. The "AM" tail code would seem to indicate that VF-21 was then operating under the command of Air Task Group 181. Note the light oil stains on the aft fuselage.



F11F-1 141812 is seen in a later permutation of VF-21's markings, that of the "AD" tail code indicating that the squadron was under the edministrative control of Carrier Air Wing 4. VF-21's mission was to train Tiger pilots

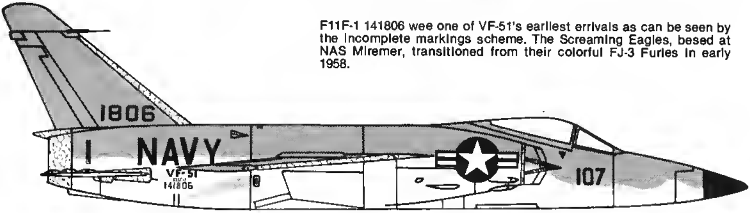


F11F-1 141841 appears here in the markings of VF-33, the "Astronauts," the only other Atlantic Fleet squadron to fly the Tiger. The lightning bolts are yellow with black edging, and the rudder is yellow with black stars. The squadron insignia is to the left of the "Astronauts" inscription

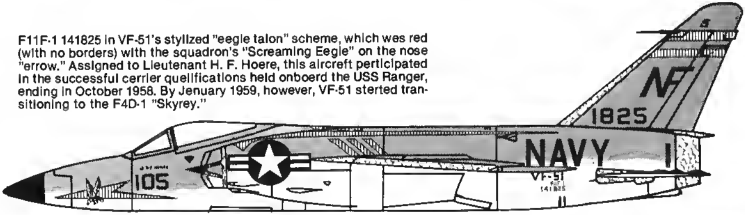


FLEET TIGERS

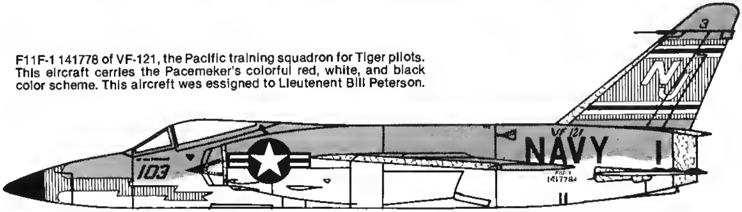
F11F-1 141806 wee one of VF-51's earliest errivals as can be seen by the Incomplete markings scheme. The Screaming Eagles, besed at NAS Miremer, transitioned from their colorful FJ-3 Furies in early 1958.



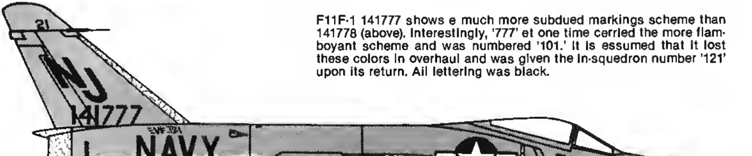
F11F-1 141825 in VF-51's stylized "eegle talon" scheme, which wes red (with no borders) with the squadron's "Screaming Eegle" on the nose "errow." Assigned to Lieutenant H. F. Hoere, this aircreft perticipated in the successful cerrier quelifications held onboerd the USS Ranger, ending in October 1958. By January 1959, however, VF-51 sterted transitioning to the F4D-1 "Skyrey."



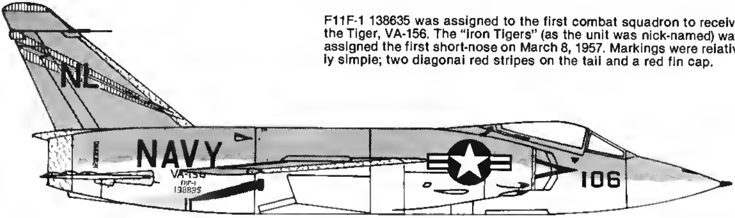
F11F-1 141778 of VF-121, the Pacific training squadron for Tiger pilots. This eircraft cerries the Pacemeker's colorful red, white, and black color scheme. This aircreft wes essigned to Lieutenent Bill Peterson.



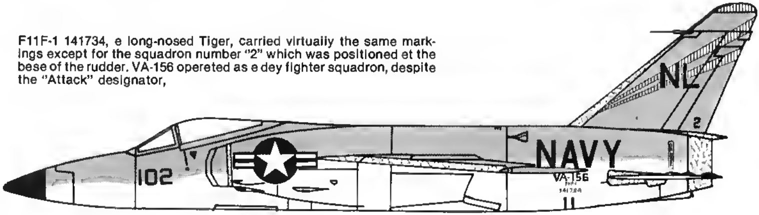
F11F-1 141777 shows e much more subdued markings scheme than 141778 (above). Interestingly, '777' et one time cerried the more flamboyant scheme and was numbered '101.' It is essumed that it lost these colors in overhaul and was given the in-squedron number '121' upon its return. All lettering was black.



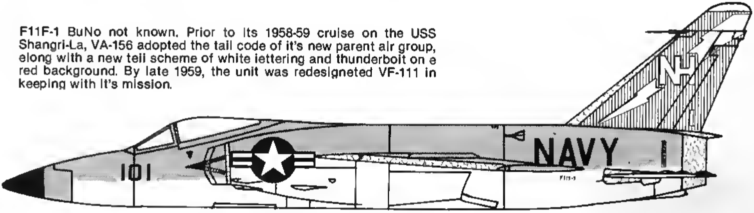
F11F-1 138635 was assigned to the first combat squadron to receive the Tiger, VA-156. The "Iron Tigers" (as the unit was nick-named) was assigned the first short-nose on March 8, 1957. Markings were relativ-ly simple; two diagonal red stripes on the tail and a red fin cap.



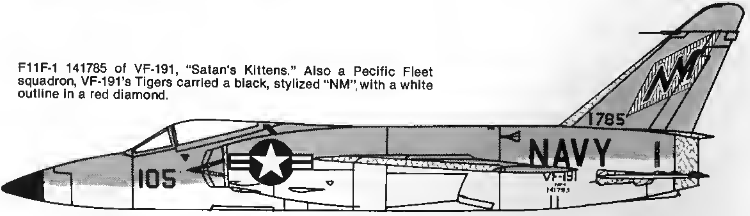
F11F-1 141734, a long-nosed Tiger, carried virtually the same mark-ings except for the squadron number "2" which was positioned at the base of the rudder. VA-156 operated as a day fighter squadron, despite the "Attack" designator,

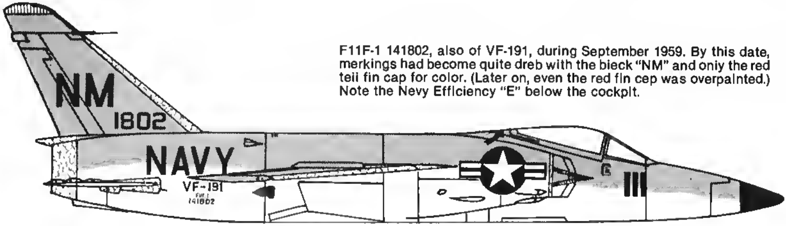


F11F-1 BuNo not known. Prior to its 1958-59 cruise on the USS Shangri-La, VA-156 adopted the tail code of it's new parent air group, along with a new tail scheme of white lettering and thunderbolt on a red background. By late 1959, the unit was redesignated VF-111 in keeping with it's mission.

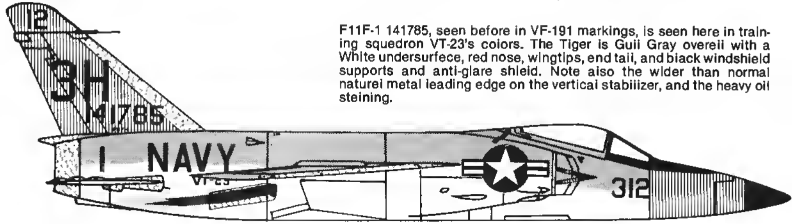


F11F-1 141785 of VF-191, "Satan's Kittens." Also a Pacific Fleet squadron, VF-191's Tigers carried a black, stylized "NM", with a white outline in a red diamond.



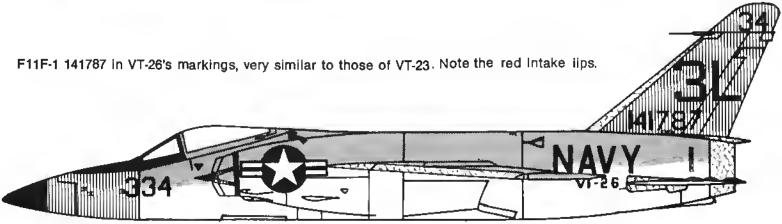


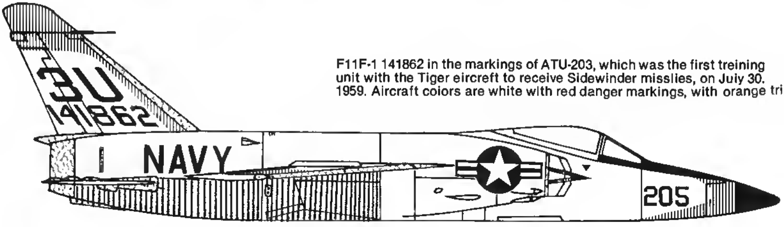
F11F-1 141802, also of VF-191, during September 1959. By this date, markings had become quite drab with the black "NM" and only the red tail fin cap for color. (Later on, even the red fin cap was overpainted.) Note the Navy Efficiency "E" below the cockpit.



F11F-1 141785, seen before in VF-191 markings, is seen here in training squadron VT-23's colors. The Tiger is Gull Gray overall with a White undersurface, red nose, wingtips, and tail, and black windshield supports and anti-glare shield. Note also the wider than normal natural metal leading edge on the vertical stabilizer, and the heavy oil staining.

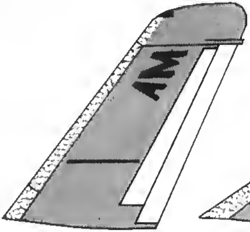
F11F-1 141787 in VT-26's markings, very similar to those of VT-23. Note the red intake lips.



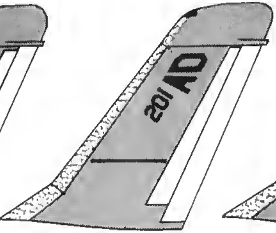


F11F-1 141862 in the markings of ATU-203, which was the first training unit with the Tiger aircraft to receive Sidewinder missiles, on July 30. 1959. Aircraft colors are white with red danger markings, with orange tri

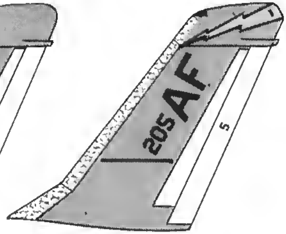
WING MARKINGS



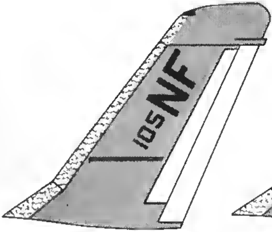
VF-21
F11F-1
(Short Nose)



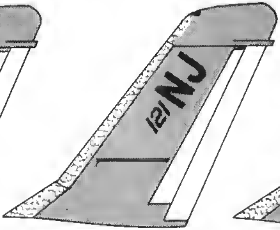
VF-21
F11F-1 141812



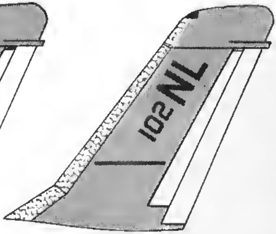
VF-33
F11F-1 141841



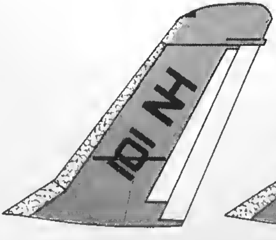
VF-51
F11F-1 141825



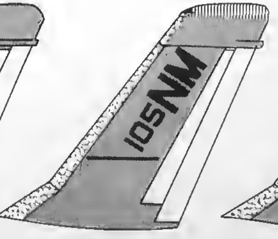
VF-121
F1F-1 141777



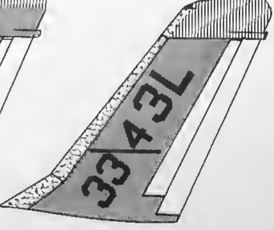
VA-156
F11F-1 141734



V A - 1 5 8
F11F-1 (BuNo unknown)



VF-191
F11F-1 141785



VT-26
F11F-1 141787


AF
1818
NAVY
220
AM
1812
NAVY